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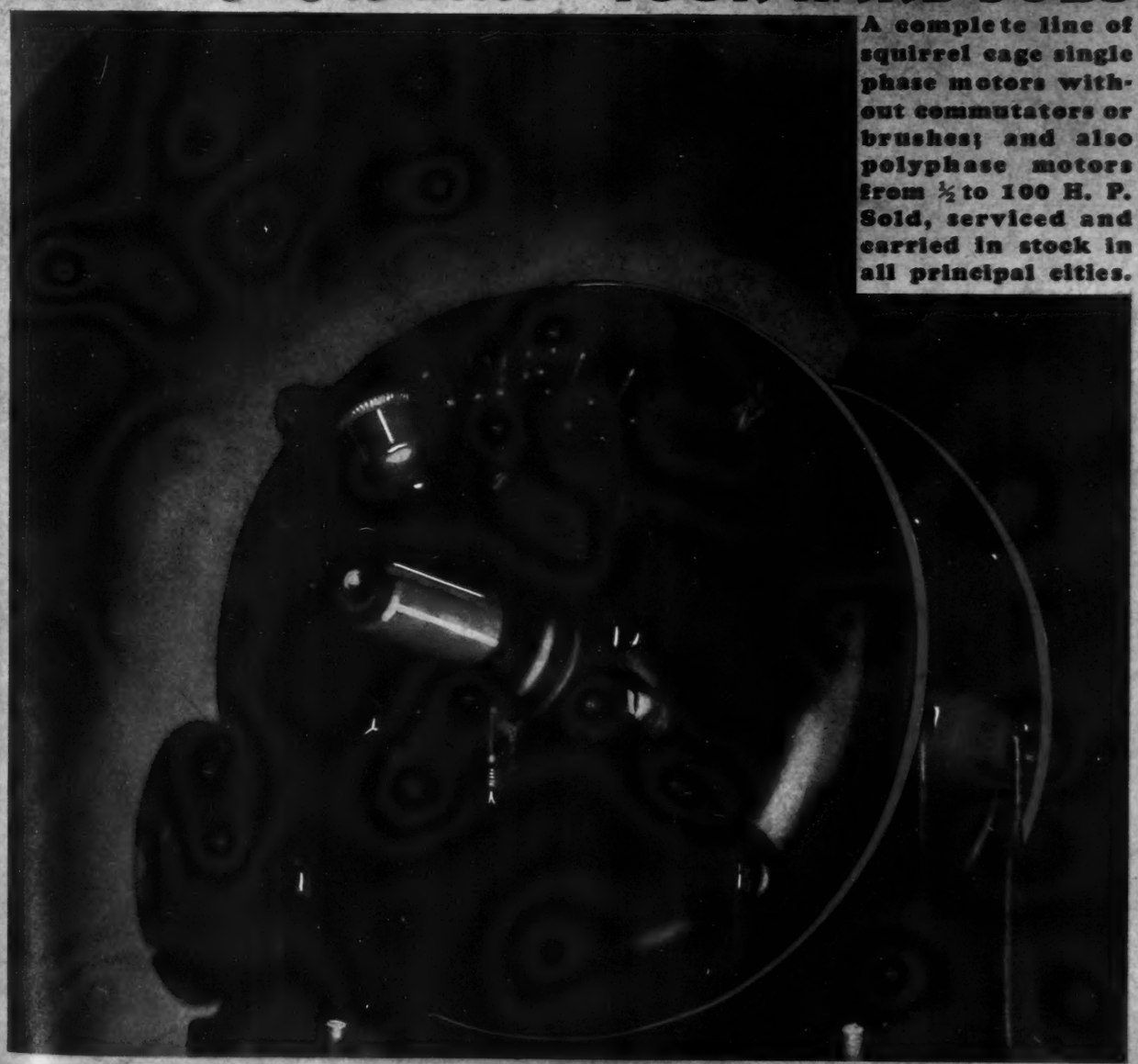

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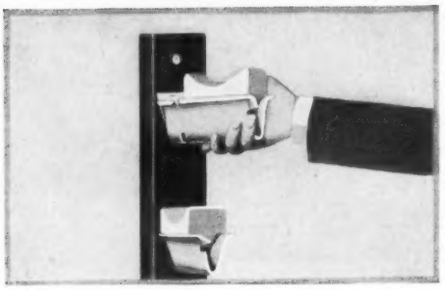

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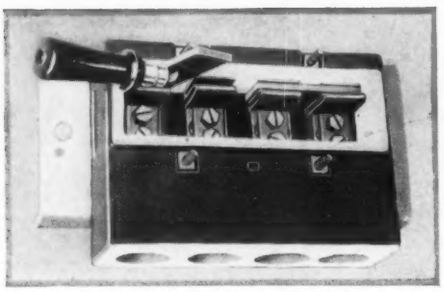

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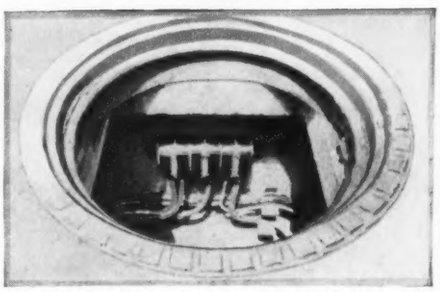
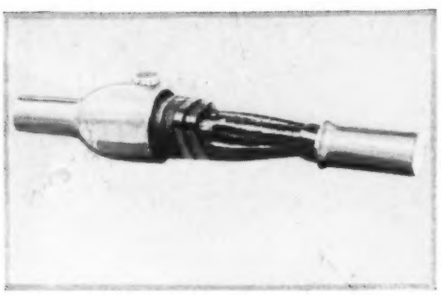


HIGH TENSION CABLE JOINTS



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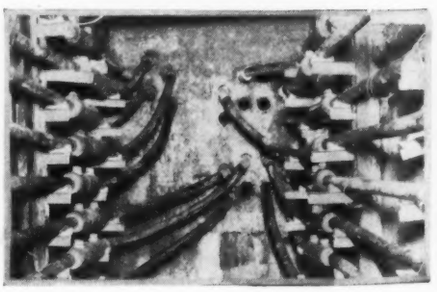

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Electrical World

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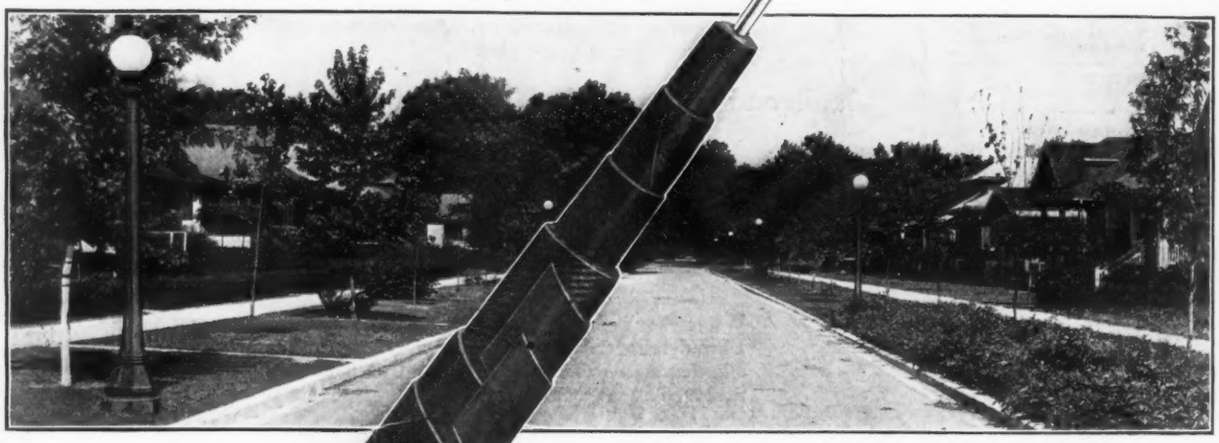

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Electrical World

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Holding-Company Regulation

AT THE recent convention of utility commissioners John F. Shaughnessy proposed state regulation of holding companies and the definition of holding companies as public utilities. His reasons are given in the abstract of his address presented on page 1153 of this issue. This proposal merits study by the industry. If it be studied, there is no doubt that the decision will be unfavorable.

Regulation is based on protection of the public from a monopoly through the supervision of rates and services rendered. This is fundamental and all commissions have this authority. Of late years regulation has gone afield in many states, where attempts to control finance, management and operation of state utilities are being made. Now it is proposed to go still further and regulate investment or holding company finances and services. It is time to call a halt on these developments in regulation. They are unnecessary to protect the public, and they mark a gradual invasion of government and politics into private business enterprises that will stifle initiative and progress and in the ultimate analysis react to prevent the growth of the light and power industry as a public service. So long as rates and services are regulated, the public is protected, and all top industry structures therefore are controlled as to their effect on service and rates. The holding company is not a monopoly and must be controlled by law as other private business is controlled.

Investment or holding companies are largely credit enterprises. They act as bankers in many respects and are subject to banking laws. They make possible the raising of funds at low rates. Many of these companies have foreign as well as local utility investments and investments in industrial and other enterprises. They are not public utilities in any sense of the word.

The time delay in raising capital and issuing securities by a local property that must go through a long-drawn-out procedure with a utility commission is unthinkable in a rapidly developing business. Money is raised and securities are issued by holding companies when money market conditions are right, and these change weekly.

The phenomenal growth of the electrical business is due largely to holding-company financing under favorable conditions, and the subsidiary properties and the public get the benefit. It is essential to have ample liquid funds instantly when they are needed if the industry is to grow economically. As a contrast it may be said that much of the lack of growth of railroads in recent years is because their financing is hedged about with such regulations that executives must try to guess money market conditions two to three months in the future. This cannot be done, so the tendency is to let expansion projects rest. Holding-company regulation would stifle capital and destroy executive initiative.

And beyond these practical considerations there are other objections to holding-company regulation. It would be a move toward political and governmental participation in business. It would afford more political jobs whose incumbents could act to mar the growth of an industry whose object is to serve public needs. What politician can measure up to the standards of initiative and enterprise utility executives have established? The utility business is a pioneering field and requires daring and intiative in its leaders. Put political control in charge and the development of the industry will be handicapped and the public will not get the benefits in future they have obtained in the past.

* * * *

Boulder Dam and Muscle Shoals in the Short Session

THE concluding session of the Seventieth Congress, which began this week, will have before it two matters of major interest to the electrical industry—Colorado River legislation and Muscle Shoals. The specially appointed board of engineers has reported on Boulder Canyon, expressing a preference for the Black Canyon site, twenty miles below the Boulder Canyon site, and estimating the cost to be at least $50,000,000 in excess of the previous estimate. This of itself shatters the contention of the proponents of the Swing-Johnson bill that enough money can be realized from the sale of electricity to amortize the cost of the project within fifty years, and it jeopardizes the chances of favorable action on the bill. Power, the expert engineers conclude, will never pay for flood protection and irrigation; and they suggest a segregation of the cost of such work from that involved in the power plant proper. Thus purely governmental functions will be separated from those involving the generation and sale of electricity, and if the recommendations of the President are heeded, the government will not engage in the power business. If the recent election decided anything, it was a mandate against government ownership and undue interference with business by government, and the President in his annual message to Congress apparently so interpreted it.

Of course, once the question of electric power is eliminated from the Swing-Johnson bill, the opposition based on disapproval of putting government in business will cease, and then the question for Congress to decide will be whether so expensive a site as either Boulder Canyon or Black Canyon is preferable to other less costly developments, involving also considerably less construction risks.

The fate of Muscle Shoals rests, so to speak, in the lap of the gods. Once power is separated from the rest of the measure, any merits which the site possesses for the manufacture of fertilizer or munitions of war ought to be apparent. Then the present confusion will be elimi-

nated, and speedy action ought to follow. Other legislation aimed at the public utilities will unquestionably be offered in the present short session of Congress; but the passage of any of it is very doubtful. The Norrises and Walshes and Reeds and others of that type have not been sustained either by the courts or by that greatest of all tribunals, the public, and while they may continue to be irritating, they will no longer be in a position to menace the growth or development of industries conducted honestly and honorably by experienced men and whose achievements for public service are worthy of high praise.

* * * *

Washington State Would Still Experiment

PUBLIC ownership enthusiasts of the State of Washington, not convinced by several successive defeats of their plans to socialize the electric utility business that the people of Washington are not ripe for further experiment in this field, are now attempting by initiative petition to submit a public ownership bill to the 1929 Legislature. The stated purpose of the bill is to conserve the water and power resources for the public and to supply water and electricity for all uses. Utility districts would be formed having power to borrow money, issue warrants and bonds and to raise revenue by an annual tax of two mills on property within the district; to construct and operate waterworks, irrigation systems and power plants; to purchase and condemn land and exercise the right of eminent domain. Powers of the district would be exercised by a commission of three serving without pay.

At first glance the ultimate consequences of the bill might not be evident, but when a provision that two or more contiguous districts may be consolidated became operative, it is easily seen that it would be a simple matter to extend provisions of the bill to the whole state, take over the entire private utility business and go into public ownership on a state-wide basis.

The State of Washington has long been conspicuous for some radical tendencies. Surely the enterprising and intelligent people of that great commonwealth, which is so rich in natural resources, might more profitably direct their effort toward establishing a reputation for sound policies in municipal and state government, holding down taxes and public expenditures to a minimum and advertising the natural advantages of the region. By that means industry and population would be attracted and the state more quickly come into its own.

* * * *

Praise for the Watt-Hour Meter

DOUBLE responsibility rests on the watt-hour meter installed on the customer's premises—responsibility to the customer and to the supply company. It is necessary that both have confidence in its accuracy. From such analyses of meter performance as are published in this issue of the ELECTRICAL WORLD, and from the records of all operating companies, one sees that the watt-hour meter is worthy of the confidence reposed in it. The article referred to is actually better evidence of the near approach to perfection reached in the meter art than are records from company files. This evidence is from a disinterested party, from the chosen arbiter, and not from a source that could, by even the most biased judgment, be considered other than fair.

Most utility regulatory bodies require meter tests at definite intervals. Probably three years is the usual period. From the statements made in the article and from the great progress that has been made in meter design and manufacturing in the past few years, it would appear that the three-year interval is short enough to protect amply the pocketbooks of consumers. It may not be out of order to inquire why the interval cannot be made four or five years without any large decrease in that protection. Lengthening of the test period would be an economic gain for both utilities and customers.

Another interesting point, which occurs at the close of the article, is the discussion of deviations from accuracy due to aging and due to handling. It appears that accuracy is more affected by the latter than by the former. From this it would seem that the practice of installing meters and leaving them in place results in a higher sustained general accuracy of all meters than does the practice of removing and installing when one customer moves out and another moves in. It is, of course, true that a meter remaining on vacant premises represents a loss in investment, but it would take quite a long period of vacancy to make that loss equal the cost of removing a meter and installing one again.

All of which is to say that the watt-hour meter is a very good performer. It sticks quietly to its knitting and drops few stitches. If all other electrical devices and equipments did half so well, there would not be among utility operating men so many brows corrugated with worry.

* * * *

Mass Production and National Progress

TO STATE that mass production is a basic element in American progress is to enunciate a precept of the modern economic kindergarten. Recent European comment upon this subject, however, warrants brief consideration of the relation of mass production to the discriminating market for electrical commodities and to the advance of general industrial and cultural standards.

Criticism of America's use of mass production asserts that it leads to excessive standardization of living conditions, to the development of stereotyped personalities, and to discouragement of originality of design, workmanship and appeal. An adequate answer to these strictures could easily occupy a modest-sized book, and in the opening chapter one might well admit that standardization carried to extremes is capable of doing much harm. The desirable limits of standardization have yet to be made clear, however, and there is at present little indication that mass production is anywhere near the danger point.

Confining ourselves to the electrical industry in order to keep within the assigned journalistic frequency band, it may be asserted without fear of intelligent contradiction that mass production and distribution of electrical energy is the key to the best service at the most reasonable rates. Heat, light and power outlets work under a great economic handicap in localities where non-uniform services exist, and some of the best engineering thought of the times has been long devoted to the elimination of excess varieties in frequency, voltage and wiring arrangements for particular purposes. Incandescent lamps are typical beneficiaries of mass production, and these benefits have been shared with the public with far-sighted comprehension of their value. Certainly, there can be little reason to condemn the progress of standardization

in the electrical industry with respect to its fundamental service and major commodities like lamps, meters, wiring devices, and probably motors for the more common uses. Selling prices are lower as a result of it, and volume of production is greater. Electrical service is in general auxiliary to the purposes of civilization, and uniformity in its type and basic commodities has little power to mold human personality, stifle originality or make living conditions monotonous.

Mass production tends to create and conserve wealth in the economic sense, and out of the surplus available for expenditure by industries and their patrons come the means of research and invention, varied designs and the cultivation of new tastes and markets. Critics of standardization seem to overlook the vital fact that in America mass production and pioneering development go hand in hand. Out of the profits of large-scale manufacture and selling come the creation of new products and the capacity to buy and enjoy commodities representing the latest advances of the handicraft arts. The beauty and utility of much recently designed electric hollow ware illustrate this point, and the industry is advancing with rapid strides in the field of artistic and decorative illumination largely because mass production earns the necessary developmental costs. Diversity of taste flourishes under prosperity from whatever cause, and the expansion of the market for high-grade electrical goods and service featuring both established and new applications and designs owes its very breath of progress to mass production, which speeds on the creative energies of industry to achievements that would be impossible indeed to realize without it on anything like a modern scale of usefulness and appreciation.

* * * *

Heating of Underground Cables

ONE of the well-known dangers to the life of a high-voltage underground cable is an abnormal expansion of the lead sheath caused by the high thermal coefficient of expansion of the impregnating compound. The lead sheath, being relatively inelastic, does not, on the cooling of the cable, return to its original dimensions, and air or gas layers are formed between the outer wall of the insulation and the sheath. These gaseous layers ionize under the electric stress, causing increase of power factor and deterioration of the insulation itself. When a cable originally cool takes on increasing load, the temperature rises first in the insulation near the conductors, the outer layers remaining relatively cool. The compound in the inner layers becomes less viscous and thus acquires a greater freedom of motion through the paper. The outer layers, being more viscous, tend to prevent the flow and expansion of the inner layers. There is thus an intermediate region in which the paper of the cable is subjected to a considerable tensile strain. The magnitude of this strain has recently been studied by Hochstaedter, the inventor of the well-known type H cable, in its relation to the load and temperature cycles usually obtaining in normal cable operation. He reaches the conclusion that within the temperature ranges now in vogue and imposed by other types of danger there is little likelihood of damage to cable arising in the failure of the paper tape through thermal expansion of the compound.

Another aspect of the matter is viewed by V. Planer in a recent number of *Elektrotechnik und Maschinenbau,* who feels that the migration of the compound, under temperature elevation of the complete cable, to the region between the lead sheath and the insulation wall may cause such serious ionization troubles by reason of its failure to return to the paper on cooling that it is desirable to prevent a rise of temperature in the outer layers so that the compound may not move outward freely owing to the causes described above. He therefore advocates, if necessary, an artificial cooling of the sheath and a maintenance of a relatively high temperature gradient through the wall of the insulation. Whether or not these effects are sufficiently definite to warrant such an artificial method of the cooling of cable sheaths seems to be open to question. The increasing adoption of the type H cable, the low-viscosity oil-filled cable, and particularly the want of uniformity of the load and temperature cycles of cables, would all appear to be influences minimizing the importance of the phenomenon in question.

* * * *

The Customer's Viewpoint in Business Development

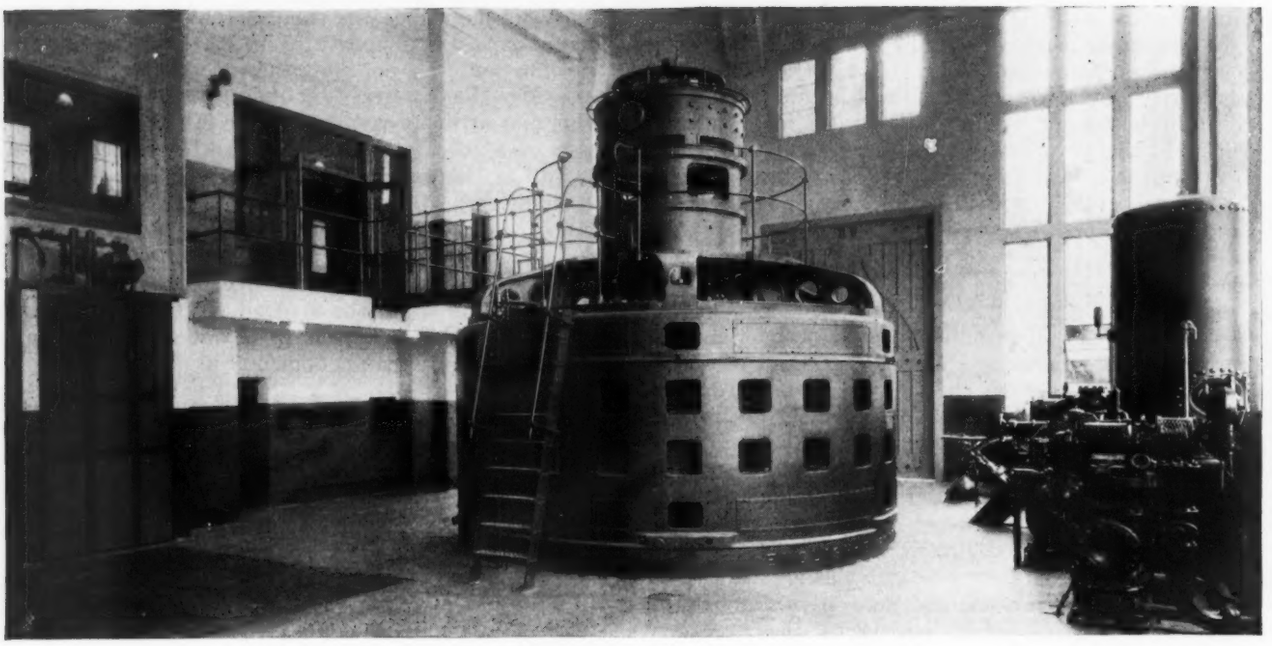
SOMETHING besides technical genius and financial sagacity is responsible for the remarkable growth of the electrical industry and must never be allowed to shrink into the background. This "something," which has been manifested in developing industrial utilization of electricity and more recently in stimulating greater domestic usage, is the growing recognition by manufacturers and power utilities that the greatest use of their product will result from ascertaining and meeting customers' requirements rather than by forcing them to take what manufacturers and utilities want to give them.

To the extent that this attitude guides future negotiations with steam railroads for electrification and purchase of power will the greatest progress be made. In negotiations for electrification of the Illinois Central Railroad, and just recently for the Pennsylvania Railroad, the application of this idea was very evident. It was realized that transportation problems had to receive prominent consideration.

As pointed out elsewhere in this issue, the same public is being served by railroads and by power utilities with money which the public has provided. To enable railroads to serve profitably at the limited return they receive, it has been recognized that power should be sold at a price which will cover only fixed charges, cost of production delivery, billing and administration, profit being secured from the return on investment to serve, as allowed by the commission. Because poor load factor, strikes, business depressions and infrequent abnormal transportation demands cannot be entirely avoided in railroad operation, it is also recognized that contracts should allow reasonable latitude of operation and impose no severe penalties in periods of adversity. Continuity of service is considered a major factor and provisions are made for assuring it.

When this attitude is taken by power companies the railroad companies have shown a voluntary willingness to pay the power utilities whatever seems reasonable to protect their investment and cost of delivering and billing power. They recognize that the best rates can be obtained if the term of the contract is long enough to allow amortization of the investment. Neither do the railroads expect to hold power companies responsible for interruptions not economically within their control.

Companies which seriously consider the customer viewpoint in future negotiations, whether they be for railroad electrification or extended use of energy in the factory or home, may find that their business will develop beyond their fondest expectations.



Automatic Hydro Plant in Operation

THE Alouette station of the British Columbia Electric Railway, Ltd., develops 12,500 hp. under a 125-ft. effective head. The station is designed for automatic operation in starting, running and shutting down. It was put in service early this year.

Significance of
Pennsylvania Electrification

What it means to other railroads, utilities and public. Reasons for further electrification and purchase of power. How financial outlay was minimized. Approach to contractual relations and underlying principles

By Allen M. Perry
Managing Editor Electrical World

THE recent announcement of the Pennsylvania Railroad that $100,000,000 will be appropriated during the next seven years to complete its electrification between New York City and Wilmington is particularly significant to every one in the electrical industry as well as to other railroads. This extension of electrification has been based on experience with electrified operation over various sections totaling around 850 miles of track, including the Long Island Railroad, the New York-Manhattan Transfer section, the Paoli and West Chester divisions and the Camden-Atlantic City division. Just recently the Pennsylvania Railroad completed electrification of the Philadelphia-Wilmington division. On completion of the program now authorized 2,260 miles of track will be electrified. Later it is planned to electrify from Trenton west to Columbia as the first step in extending electrification to Pittsburgh.

Decision Based on Experience

Adoption of electric operation over the divisions mentioned indicates that the executives of the Pennsylvania Railroad are convinced of the advantages in their case of electrified operation over steam where long tunnels which cannot be economically ventilated are involved, where terminals are congested, where trunk-line and commuter traffic are dense, and where track space is limited entering the hearts of large cities. As indicated in the accompanying interview with Elisha Lee, executive vice-president of the Pennsylvania Railroad, electrified operation permits handling more traffic without increasing trackage, by enabling the haulage of heavier trains, increasing schedule speeds, avoiding double heading and increasing acceleration. Simplification of the terminal problem is also a factor. In addition electric locomotives do not have to stand idle so long as steam locomotives for inspection and repair, drawing no return on the investment. Combined with the greater riding comfort, improvement of adjacent property value and the possibility of utilizing air rights for real-estate development, the foregoing benefits have demonstrated to the Pennsylvania Railroad the economic advantages of the authorized electrification.

Additional significance is found in the fact that the Pennsylvania Railroad has made arrangements to purchase power. The decision has more than ordinary importance because this railroad has had the opportunity to compare the desirability of generating its own power (as done for the New York-Manhattan Transfer section) with purchasing power (as done for the Paoli division). The economic advantages of purchasing power are brought out on the following page.

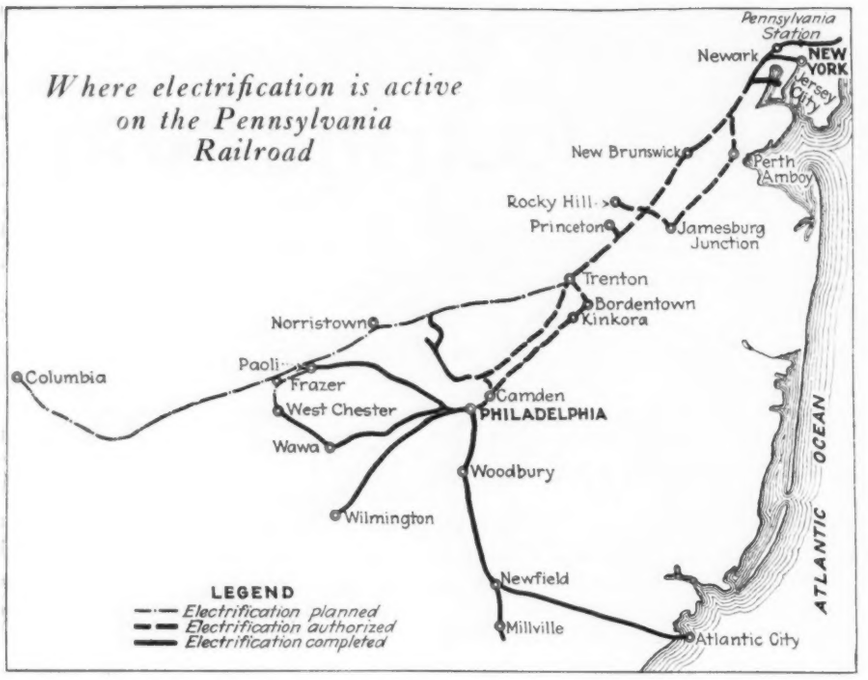
Significance to Utilities, Manufacturers and Public

From the viewpoint of all utilities, this extension of electrification of the Pennsylvania Railroad and its decision to purchase power are significant in that they indicate what other railroads may profitably do where they have terminal, tunnel, grade or dense traffic problems that cannot be solved because of limitations to laying additional tracks.

As an indication of what railroad electrification load means to the utilities that may be called upon to supply power, it is interesting to note that the electrified section of the Pennsylvania Railroad prior to the Phila-

High Lights of Pennsylvania Railroad Electrification

Miles of railroad to be electrified	325
Miles of track to be electrified	1,300
Electric locomotives required	365
Passenger	165
Freight	200
Present	84
Passenger trains to be operated	536
By electric locomotives	318
As multiple units	218
Estimated cost to complete program	$100,000,000
Estimated time to complete program, years	6 to 7
Saving in number of freight trains operated (approximate per cent)	50
Speed freight trains under electric operation, miles per hour	25
Size freight trains to be operated (cars)	125
Miles of railroad already electrified (including Long Island Railroad)	333
Miles of track already electrified	960
Total miles of Pennsylvania Railroad line to be electrified on completion of program	658
Total track mileage to be electrically operated	2,260



delphia - Wilmington electrification drew 88,700,000 kw.-hr. from the Philadelphia Electric system in 1927, or 5.3 per cent of its entire output, with a peak equivalent to 6.6 per cent of the system peak, but not necessarily imposed on it. If the railroad's estimate of energy required from the Philadelphia Electric system in 1936 materializes, 730,000,000 kw.-hr. will be required with a 130,000-kw. peak. Based on the Philadelphia system output expected at that time this single railroad electrification will require about 15 per cent of the electric service company's output and will probably increase the Philadelphia load factor 1.5 per cent.

Railroad electrification means more than purchase of electric locomotives. It requires the installation of generating, transmitting, substation and metering equipment. This involves boiler and turbine room apparatus, oil circuit breakers, relays, copper, insulators, instruments, transformers, etc. What relative amounts will be spent for each can be judged by any one conversant with the proportionate investments for these things in existing systems. If the investment to supply electricity to the railroad bus is $2\frac{1}{2}$ times the cost of the generating plant, which it may be, the equipment expenditures of the power company alone may be around $300 per kilovolt-ampere. For just the demand mentioned the investment might be calculated to attain around $39,000,000, exclusive of the railroad's purchases.

From the public viewpoint railroad electrification means more than improved transportation and greater riding comfort. To the extent that railroads and other large industrials purchase their power supply will the general

Some Reasons for Purchasing Power

Railroad electrification causes relatively low initial load compared with ultimate development, but *instantaneous peaks demand big initial investment for power supply.*

* * *

If railroad supplies it own power it *must include a larger percentage of reserve capacity* with consequently higher capital costs than electric service company would to supply that load.

* * *

If a railroad electrifies gradually, which is the only economical thing to do, it has two alternatives in providing generating facilities:

1. It can hold down its initial investment by dividing its generating capacity among a sufficient number of units so one can carry base load, another peak load and a third of equal size can serve as reserve. This procedure requires small units which may not be as economical as desired when the ultimate electrification is completed. If for reliability of supply generation is divided among several plants the initial cost is higher and the ultimate economy worse. *Obsolescence will work fast under these conditions.*

2. It can install larger units which will be more economical in the ultimate layout, but in this case a larger reserve unit must be installed and the *initial investment is greater.* Furthermore, the initial *operating economy* of these units will be *less* because they are larger than initially needed. If for reliability of supply the generation is divided among several plants all these objections are augmented.

A railroad generating its own power *soon finds its equipment obsolete before it can amortize it,* whereas electric service company with larger system and continual increments of equipment can find more extensive economical use for obsolete equipment on peak loads.

* * *

Electric service companies with their larger systems and continual increments of equipment *can use their most efficient units for a larger percentage of the load.*

* * *

Electric service companies are specialists in power supply and therefore have certain advantages over railroads, which could *not provide such collective talent without incurring great expense.*

* * *

Money is not tied up by railroads in power plants during depressions, strikes, etc., if power is purchased.

* * *

Additional demands for power can be promptly supplied without waiting for a power house to be built or extended if purchased power is used.

* * *

For the same and even less cost, *purchased power is more reliable* because of multiplicity of generating sources and plurality of feeds.

* * *

Electric service companies are in *better position to supply power economically,* not only from an investment but production viewpoint.

public and particularly domestic customers have the greatest opportunity to secure the best service and the lowest rates. In the accompanying interview with W. H. Taylor, president of the Philadelphia Electric Company, an interesting analysis of this relationship is made.

Procedure Minimizes Capital Outlay

It is important to observe that the Pennsylvania Railroad did not attempt to electrify a whole division at once, but has made and is making the conversions gradually in the order of their economic importance. For example, the first step of the newly authorized construction will involve the section between North Philadelphia and Trenton; the next step will be between Manhattan Transfer and New Brunswick, and the final section between New Brunswick and Trenton. In other words, the most congested terminals and suburban lines are electrified first; then electrification is extended each way from electrified terminals over the most heavily traveled sections, and finally the intervening links are converted as economy and necessity dictate.

As a result of this procedure and the decision to purchase power financing of the electrification has not incurred and will not produce the initial burden which some railroad executives consider always attends electrification. While the $100,000,000 undertaking authorized sounds like a big financing burden, it will be spread over six or seven years—about $15,000,000 a year. Of this about 60 per cent will be for catenary, transmission lines and substations and 40 per cent for rolling stock. This authorization will be a normal percentage of the railroad's regular improvement expenditures, which have averaged $70,000,000 a year. Furthermore, the proposed capital expenditure will make unnecessary certain other capital expenditures which would have to be made if electrification were not carried out. Existing steam motive power will not be scrapped, but will be transferred to other divisions of the railroad still operated by steam.

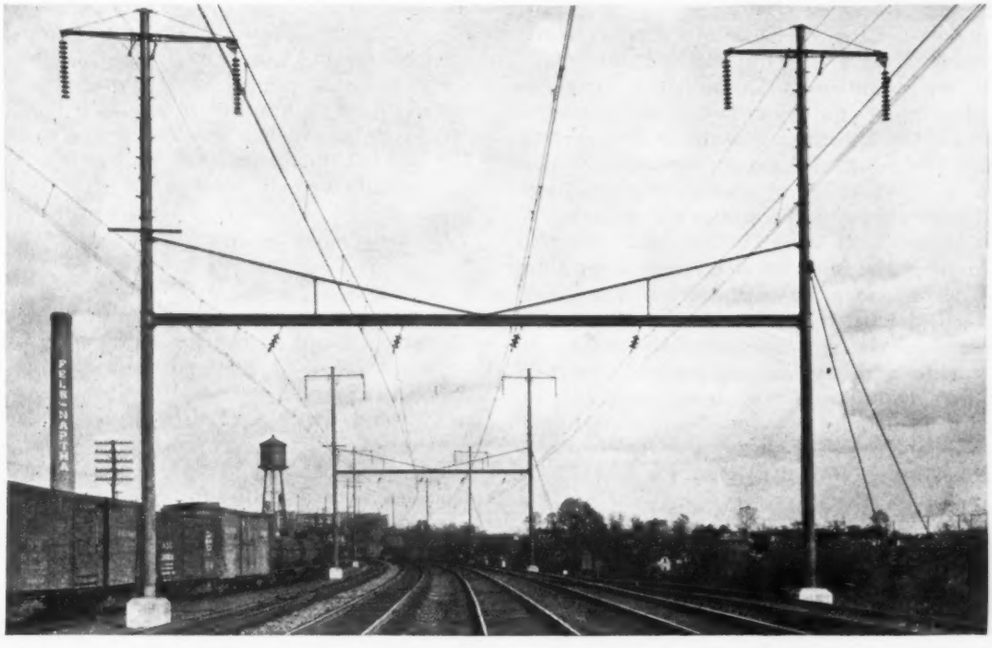
Negotiations for the sale of power were entered into by the Philadelphia Electric system with the distinct realization that both the railroad and electric service companies serve the public in common. In the interest of the public, which pays the bill eventually, it was advisable to charge no more than the fixed charges which continue whether energy is used or not plus the actual production cost and a fixed percentage to cover delivery, billing, administration, etc. Mr. Taylor's comments on contractual relations elaborate on this joint responsibility.

Until the authorized program is completed power will be supplied to the railroad under contracts which have been in existence. However, agreements have been made between the railroad and power supply companies as a basis for proceeding with electrification.

Underlying Principles of Agreement

Underlying principles which constitute the features of the agreement with the Philadelphia Electric system are presented in the interview with Mr. Taylor. In general, they protect the rights of both parties, but are intended to give sufficient latitude of operation so neither party is handicapped. As explained before, energy is charged for on the basis of a demand charge plus the energy cost at the bus plus a fixed percentage to cover cost of delivery, billing and administration. The demand is determined each month and, with some exceptions, cannot be less than 75 per cent of the previously established demand.

Abnormal demands, if not too long in duration will be supplied without increasing the demand charge if the power supply company can do so without handicapping its general service. The railroad guarantees to pay for 30 per cent of the kilowatt-hour equivalent of the maximum demand with certain limitations. Provision of reliable service is an important feature of the agreement, but the utility company is not penalized for interruptions beyond its control. Failure to deliver energy modifies the demand charge and load factor guarantee and provision is made so the railroad can cancel the contract if continued interruptions within the control of the power company are not remedied within a reasonable period. The demand charge is fixed by book values of investment and the energy charge is based on actual bus costs computed yearly. Arrangements are made for relieving the electric service company of the investment in equipment installed solely to serve the railroad in case the contract is terminated before the investment is amortized.



Section of recently electrified Philadelphia-Wilmington division

Railroad Executive's Views

Why the Pennsylvania Railroad decided to spend $100,000,000 for further electrification and why it will purchase power. Some comments on contractual relations

An interview with
ELISHA LEE
Vice-President Pennsylvania Railroad

ELECTRICAL WORLD readers have frequently heard why electric light and power companies believe steam railroads should electrify and purchase their power. As sound as these arguments may be, however, it is interesting and probably more valuable to hear from a steam railroad executive's own lips why his railroad has extended electrification and has decided to purchase power for future needs as is the case with the Pennsylvania Railroad. Consequently, Elisha Lee, vice-president of that system, was approached with this introductory question. He replied:

Elisha Lee

"Many technical considerations are involved which are too numerous and intricate to discuss in a short time, but perhaps a general review of the situation may answer your question. First of all, our own experience, coupled with observations throughout this country and abroad, indicate very definite advantages for electric operation under certain conditions. It eliminates smoke and gases where trains must be routed under subsurface terminals, such as required for the New York-Pennsylvania station and the new through West Philadelphia station and the new subsurface suburban station at Broad Street in Philadelphia. It increases the capacity of dead-end terminal stations, because by substituting multiple-unit electric motor car trains for locomotive trains there is a 75 per cent reduction in train handling movements per train over the interlocking head of the station—specifically, a reduction from eight with steam to two with electric. This greatly helps at the point of maximum congestion in a station. At Broad Street, Philadelphia, we had reached the practical capacity of that station some years ago, and we began to electrify our suburban services to obtain relief, starting with one line and gradually extending it to the others up to the present time.

"Of course for long tunnel operation, such as is found in the river tubes at New York City, electric operation is the only practical solution of the ventilation problem.

Benefits of Electrification

"For main line operation electrification permits handling more traffic without increasing trackage or number of locomotives, by enabling haulage of heavier trains, the elimination of double-heading and by increased acceleration and higher running speeds. Where, as is the case with us, we are approaching what we believe is the practical capacity of steam locomotives and can by electrification haul a 50 per cent heavier freight train and can also increase the average speeds, it follows that main line capacity is increased and congestion reduced.

"Still another advantage is found in the fact that electric locomotives, or their equivalent, the multiple-unit cars, do not have to stand idle so long as steam locomotives do undergoing inspection and repairs and drawing no return on the investment.

"Collectively the direct economies produced by these advantages do not always justify the expenditure of vast sums of money for electrification, but in certain cases they may, as, for instance, where traffic is very dense and existing trackage facilities are congested. You will observe that many of the advantages cited benefit the public by increasing comfort, speed and punctuality; in other words, giving the public better service. Since our rates are fixed, better service is the only way of attracting more business and consequently more profit. Therefore, we are vitally interested in anything that can be economically done to improve service."

At this point Mr. Lee was interrupted by the question: "You haven't mentioned the real estate value of air rights or improvement of adjacent property values made possible by electrification. Are these advantages overemphasized?" To this question Mr. Lee replied:

Value of Air Rights

"You realize that we have capitalized on the air rights in New York and so has the New York Central. We have not overlooked other possibilities in this direction, although they are determined by the nature of the districts through which the railroad runs. I would say that the value of air rights in the hearts of large cities and in some residential sections is an important factor to be considered in determining the economy of steam railroad electrification. But it is obviously a very special consideration, and one that can be of an economic advantage only where property values are very high."

These statements of Mr. Lee explain some of the reasons for the original electrification, the recently com-

pleted extension and the authorized completion of the New York-Wilmington electrification, which has proceeded in gradual steps in the order dictated by economy and necessity. But he was asked to explain what recent developments dictated the next steps to be taken, to which he answered:

"As explaining in very general terms only the recent large electrification program which we have announced, I might say that the following considerations were guiding ones:

"Traffic in and out of Philadelphia has increased so that the Broad Street terminal will before long become inadequate; physical enlargement was impracticable because of the limitation of abutting streets; congestion and delays frequently occurred, caused in part by idle movements of steam locomotives. The electrification of the suburban lines gave material relief, but the building of a new through terminal west of the river properly to care for through train movements now and in the future became necessary. This station had to be a subsurface one. For the suburban business, a new subsurface station had to be built, adjoining the present Broad Street station. Electric operation into these terminals was essential, and economical operation and elimination of delays from changing motive power required the electrification of the lines approaching the terminals, preferably to the end of the individual runs of the trains." (This makes electrification from Philadelphia to Trenton the next logical step.) "Hence the company determined to inaugurate its comprehensive electrification plans in order to secure to the fullest all possible advantages direct and indirect to the company and to the public.

"Newark station also presented its traffic-handling problems, although they are not as serious as in Philadelphia. Because of these problems and the delays in changing from steam to electric locomotives and vice versa at Manhattan Transfer, the next step after handling the Philadelphia-Trenton section will be to electrify from Manhattan Transfer through Newark station to New Brunswick.

"Finally by electrifying the gap between New Brunswick and Trenton we will avoid changing locomotives at these points and achieve the full benefits of electrification, but this step will come last of all. Later we will consider electrification of the tracks east of Pittsburgh, with their mountain grades, over which electrification has additional advantages. But here again economic considerations will compel us to electrify gradually.

Why Power Was Purchased

The Pennsylvania Railroad has had experience with generating power for the New York-Manhattan Transfer section and purchasing power for the Camden-Atlantic City and Philadelphia-Paoli sections. Therefore Mr. Lee was asked why his company has decided to purchase power. He said:

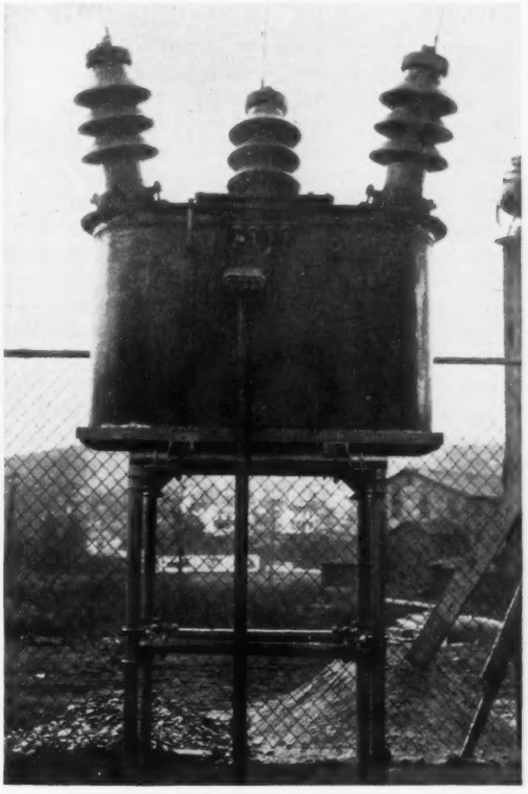
"Whether we generate or purchase power depends entirely on local conditions. An agreement has been made with the Philadelphia Electric Company which we feel is mutually attractive.

"The conditions, however, surrounding the agreement are quite special and in this case we found that we could purchase power as cheaply as we could make it. Furthermore, the power company had unusual facilities in the way of generating plants which would give us guarantees for continuity of supply. The power company was also willing to give us the necessary latitude to care for unusual operating contingencies without our being unduly penalized, a factor which is absolutely essential."

Relaying of 132-Kv. Lines Less Costly with Potential Transformer Unit

By H. A. P. Langstaff
Relay Engineer West Penn Power Company, Pittsburgh, Pa.

THE high cost of 132,000/110-volt potential transformers often precludes the use of relay schemes which materially involve the operation of a 132-kv. transmission system. A recent development by the manufacturers, using bushings as a source of potential supply, has materially improved this situation, but the bushing type is limited in its capacity. The West Penn Power Company has recently devised a combined unit which involves a decided saving and provides a potential supply suitable for all purposes.



Potential transformer unit minimizes costs for 132-kv. relaying

This unit is composed of three of our standard 132-kv. bushings, equipped with potential supply taps mounted in one tank, housing two single-phase transformers connected open delta. With this combination there is available three-phase Y-Y potential from the bushings as a source of potential supply for the functioning of directional ground relays and three-phase open-delta, ample capacity-potential supply for the functioning of directional phase relays. The potential from the bushings is somewhat limited, but with the combination of the three bushings sufficient capacity is available to function quite a number of directional ground relays. Most 132-kv. failures are from one wire to ground.

Comparing this unit with three single-phase units, a saving of approximately $4,000 is involved and the use of one tank rather than three economizes on foundations, space and maintenance.

Contract Relations
with Railroads

What the Pennsylvania Railroad electrification means to the Philadelphia Electric Company system and the country. Fundamentals to consider in contractual relations. Principles involved in agreement

An Interview with
W. H. TAYLOR
President the Philadelphia Electric Company System

W. H. Taylor

IN ANNOUNCING its decision to complete the electrification of the New York-Wilmington division during the next six or seven years the Pennsylvania Railroad also stated that arrangements had been made to purchase power from the Philadelphia Electric Company system. In view of this it was believed that utility executives all over the United States would be interested in knowing the significance which the president of that company, W. H. Taylor, attaches to the electrification from a local and a national viewpoint. His opinions on what should constitute the underlying principles of agreement for purchase of power were also sought. When approached on this subject Mr. Taylor said:

"The decision of the Pennsylvania Railroad to extend its electrification seems to indicate very forcibly that the executives of that road consider electrification a better means of increasing transportation facilities than laying additional tracks. Since the Pennsylvania road has had experience with electrification and with generating and purchasing its power requirements its recent move is particularly significant. As the specific advantages of electric operation become more widely known, I feel that steam railroads will adopt electrification more extensively when traffic density indicates its advisability. Meanwhile the Philadelphia Electric Company system is prepared by its layout and development for any loads that may be imposed upon it."

Fundamental Principles to Consider

After these comments Mr. Taylor was asked to relate what fundamental principles he considers should guide contractual relations in supplying power to railroads.

"In general," he replied, "it appears to me essential that the representatives of the railroad and the utility should meet upon common ground—the railroad presenting complete information as to the character and amount of service required for present and future needs and the utility forces giving complete consideration to the delivery of service in all respects equal to or better than the railroad could produce to meet the requirements of their situation."

Mr. Taylor was asked if he would outline some of the important considerations in the agreement for the supply of energy to the Pennsylvania Railroad.

"Speaking broadly," he said, "the fundamental principle underlying our negotiations was the conviction that the railroads and the electric service companies, since they serve the public in common, should consider the question of power supply as one of mutual interest and importance. It is evident that the service to the public by each utility should be supplied in the very best way, and that full consideration should be given to all the economics of the combined situation. It was felt essential, in the interest of the public, that the railroads should pay no more than a fair return on the capital investment required to serve them, plus the actual production costs at the generating station bus, and a fixed percentage for delivery, billing, administration, etc.

"The agreement is intended to protect the interests of both parties and to provide sufficient latitude of operation and flexibility in all of its features so that the purpose of the agreement may be fully carried out as the work of the electrification develops in size of demand and amount of energy to be supplied.

"Provision for reliable service of such a character as to be of value in the conduct of the railroad business must be recognized as of primary importance in any agreement for railroad supply. The entire success of the electrification rests upon reliability of service, and the railroad must be in a position to cancel its agreements if such reliability of service is not established and maintained. Interruptions in the supply, for reasons beyond the control of the utility, should not penalize the company.

"Abnormal demands may be expected in the conduct of the railroad business. These may proceed from wrecks, congestion of traffic or from low temperature conditions. The agreement recognizes these conditions and provides to meet them without penalizing the railroad, provided that the company can do so without handicapping its general service.

"Energy under this agreement will be sold to the railroad, when the existing demands are increased due to through electrification, on the basis of a demand charge which is fixed by the investment, plus the actual bus cost computed annually, to which there will be added a fixed percentage to cover additional costs in the transaction of this business for the railroad company. The maximum demand to be billed is determined each month and, with some exceptions, cannot be less than 75 per cent of the maximum demand previously established. The load factor guarantee is 30 per cent, subject to certain limitations.

The abnormal demands along the nature of those previously mentioned will not penalize the company after their occurrence.

"Recognizing the fact that a long-term contract is of mutual advantage in an agreement of this character, a period of twenty years was agreed upon. In the event of a cancellation, the agreement provides for relieving this company of the investment in equipment installed for the specific service of the railroad company."

Since it was inferred during the course of the conversation that the Pennsylvania Railroad's estimated requirements from the Philadelphia Electric Company system would constitute about 15 per cent of the company's output in 1936 (when this electrification is expected to be completed), the question arose whether it is safe for an electric service company to serve one customer having such large demands. Mr. Taylor made the following explanation:

"Even though a railroad is subject to strikes and business depressions, it never stops running for any length of time, at least. Transportation of people and freight continues, even if diminished in proportions. The power required is not reduced in the same proportion that its business is. Furthermore, you will recall that the demand charge which covers return on investment continues under such conditions. If no energy is supplied, according to our agreement, the guaranteed load factor is modified but not entirely waived. Therefore, we are at least assured of capital charges, and what energy charges we collect will provide for other expenses which continue regardless of whether energy is delivered or not. We do not financially burden the railroad at a time of adversity, but still we are protected. Consequently, even though we should lose a large part of our kilowatt-hour output under these conditions we do not suffer a loss."

Value of Industrial Load to Domestic Customers

In selling power to large industries like railroads, politicians and self-seekers frequently attempt to delude the public, and particularly domestic customers, into believing that they are paying for the energy used by these industries. The Electrical World knows this is not so, but asked for Mr. Taylor's reply to such a criticism. He said:

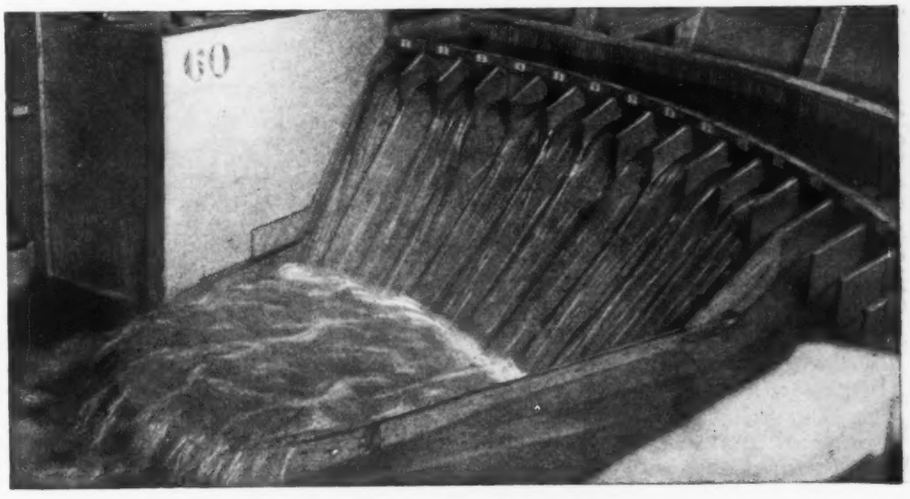
"To the extent that industries collectively purchase power will the general public have the greatest opportunity to secure the best electric service and lowest electric rates. This has been demonstrated in the past, as is shown by a study of the concurrent improvement of service and domestic rates and the utilization of purchased power by industry. Some of the reasons for this may be appreciated if it is assumed that industrial load is no longer carried by a utility system. The amount of generating capacity would be determined by the lighting peak, so there would be little reduction in this investment. For the same reason the investment in transmission lines, substations and distribution systems would be only slightly less. Consequently, the expenses which continue whether energy is supplied or not, and which constitute around 90 per cent of domestic rates at present, would not be materially reduced and would have to be spread over the comparatively few kilowatt-hours used by domestic consumers. This would increase their rates almost in the ratio of total kilowatt-hours which would be supplied if industries were served to the kilowatt-hours supplied for domestic load only. This change would occur without considering the energy cost component, which would become a bigger item in domestic rates because energy could not be produced as economically without the high load factor produced by combined industrial and domestic loads.

"Therefore, the public would be far better off to allow utilities to supply energy to large industries and railroads, even at cost, than to impose any economic restrictions on the industrial use of purchased power. The availability of cheap power to industry encourages the widespread location of new industries, permits industries to utilize electricity most extensively and thereby make more profit. Under these conditions, industry is in a financial position to hire more labor, pay better wages and increase circulation of money which supports commercial enterprises and the public dependent upon them for a livelihood."

Hydro-Electric Models Eliminate Design Guesswork

THE hydraulic laboratory of the Alabama Power Company, under the direction of I. A. Winter, investigates the nature of factors otherwise indeterminate and saves both time and money for that Southern utility. Miniature scaled structures are prepared in detail for each development.

Several very interesting problems were worked out satisfactorily by means of the small-scale model before the Martin Dam was constructed. According to Mr. Winter, "It was necessary to construct this model to a scale of 1/100 to study the spillway conditions at the plant. In addition to the complete spillway, consisting of twenty gates, it was necessary for the laboratory to reproduce the equivalent of 1,000 ft. of river bed below the dam. By the use of this model it was possible to



Hydro model predicts flood conditions

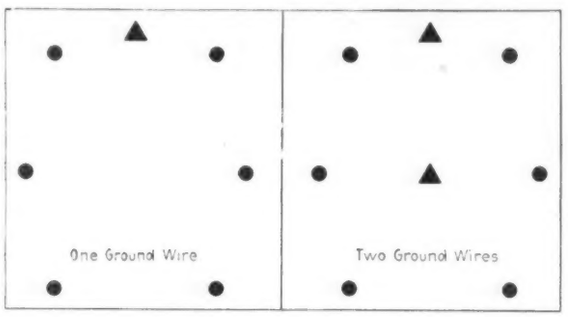
design the spillway aprons in such manner that the destructive action of the floodwater on the river bed was reduced to a minimum. A flood of 60,000 cu.ft. per second passed over Martin Dam last spring. The stilling basin and banked spillway were given a thorough test at that time and the structure proved a complete success, working identically as predicted from the model.

"These models are kept in the laboratory throughout the construction period of the project. It is gratifying to be able to reproduce a flood of any magnitude up to 200,000 cu.ft. per second as desired, without waiting 25 or 50 years for nature to furnish the necessary water."

Protective Value of Overhead Ground Wires

By Howard P. Seelye
Engineering Division, Detroit Edison Company, Detroit, Mich.

IT IS generally accepted that an overhead ground wire on a transmission line will reduce the voltage of a lightning surge about 50 per cent. A second ground wire will further reduce the voltage but in a lesser degree, probably 30 per cent of the voltage with one ground wire. Ordinarily it has been assumed that the reductions in



Arrangement of conductors and ground wires on two-circuit line

surge voltage thus effected are direct measures of the protective value of the ground wires. However, there are other factors which should be considered in judging that protective value, the flashover voltage of the line insulation and the probable voltage-frequency relation of lightning surges having an important bearing.

In an address on "Relation Between Transmission Line and Transformer Insulation," given before the American Institute of Electrical Engineers at New Haven, Conn. (see extract in Electrical World, July 28, 1928, page 163), W. W. Lewis of the General Electric Company gives a considerable amount of data on the actual voltages which may be expected on transmission lines, on the effect of ground wires, on insulator flashovers, etc. Assuming a concrete example of a 132-kv., two-circuit line arringed as in the diagram, the following data may be deduced. The maximum surge voltage is assumed to be 100 kv. per foot of height of line, the line wires being assumed to have an elevation of 90, 80 and 70 ft., respectively, at towers, and 30-ft. sag. This makes the average height of the wires above ground 10, 60 and 50 ft., respectively. Then, using the protective ratios given by Mr. Lewis in the case of conductors arranged as shown, the following maximum potentials to ground may be obtained:

POTENTIAL TO GROUND (KV).

	No Ground Wire	One Ground Wire	Two Ground Wires
Top wire	7,000	2,940	2,520
Middle wire	6,000	3,120	2,280
Bottom wire	5,000	3,100	2,200

In order to prevent any flashovers it would be necessary to use strings of 19, 18 and 17 disks respectively on the three wires with two ground wires. If the normal line insulation consists of nine disks per string, the flashover is given as 500 kv. at 60 cycles and 1,280 kv. under lightning surge impulse. Using this figure, it is apparent that the line insulation has only the following per cent effectiveness:

RATIO OF FLASHOVER OF NINE DISKS TO MAXIMUM POTENTIAL (PER CENT)

	No Ground Wire	One Ground Wire	Two Ground Wires
Top wire	18.3	43.6	50.9
Middle wire	21.3	41.0	56.2
Bottom wire	25.6	41.3	58.2

In an article for the *Electrical Journal* for August, 1928, H. L. Wallau calls attention to the work of Cox, McAuley and Huggins on the determination of the relative frequency of surges of different potentials as given in their paper before the A.I.E.E. in February, 1927 ("Klydonograph Surge Investigations"). He shows that their data, if plotted to logarithmic co-ordinates, give practically a straight line of the equation, $\log y = \log 895 - 0.5 \log x$, y being the surge value in kilovolts and x the percentage of surges exceeding any given voltage. If, instead of using an actual value of maximum potential, which is 895 kv. in the foregoing equation, y is used to represent the per cent of that value, the formula may be written

$$\log y = \log 100 - 0.5 \log x$$

$$\text{or } y^2 = \frac{100^2}{x}$$

This indicates the probability of the occurrence of a surge of any given percentage (y) of the maximum surge which can occur. The preceding table gives the percentage which the line insulation bears to the maximum surge voltage under various conditions. Using this as y in the formula, therefore, the probable percentage of surges (x) greater than the line insulation will be found; that is, the probable percentage of the total number of surges occurring on the line which will be great enough to flash over the insulators.

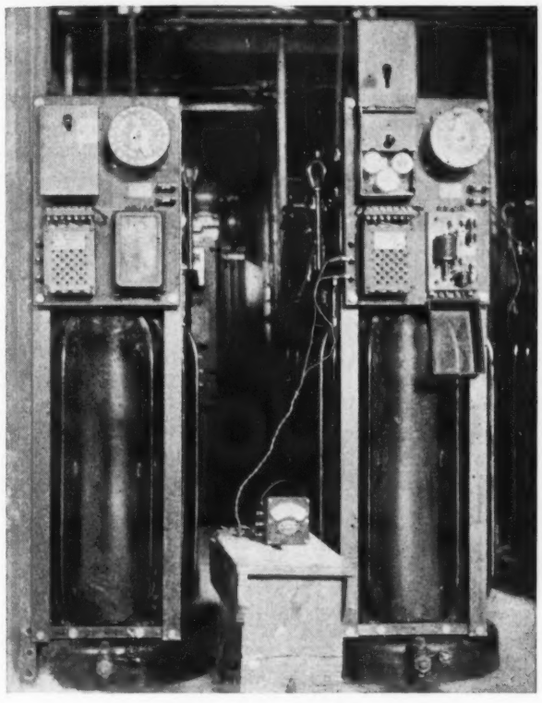
PROBABLE PROPORTION OF SURGES OVER IMPULSE FLASHOVER OF NINE DISKS (PER CENT)

	No Ground Wire	One Ground Wire	Two Ground Wires
Top wire	29.8	5.26	3.86
Middle wire	22.0	5.96	3.17
Bottom wire	15.3	5.85	2.95

These analyses give a true idea (provided the data and assumptions used are correct) of the value of one and two ground wires in protecting a line against flashover. It is evident that the insulators alone without ground wire give 70 per cent protection. One ground wire raises this to about 94 per cent, but the second ground wire increases this only about 2 per cent more. The value of one ground wire is apparent, but it is doubtful if the expense of a second ground wire is often justified by such a small increase in protection.

Conveniently Located Regulator-Control Panels

By T. A. Robinson
City of Winnipeg Hydro-Electric System, Canada



Control panels mounted on frames attached to regulators

TO FACILITATE the testing and adjusting of automatic induction voltage-regulator-control equipment, it is well to have the control panel located at a convenient height and readily accessible. A substation of the Winnipeg hydro-electric system, with two regulators having their auxiliaries mounted 5 ft. from the floor, is shown in the accompanying illustration. Current and potential test terminals are provided. The voltage may be read directly across the potential transformer or after the drop through the compensator has been subtracted from it.

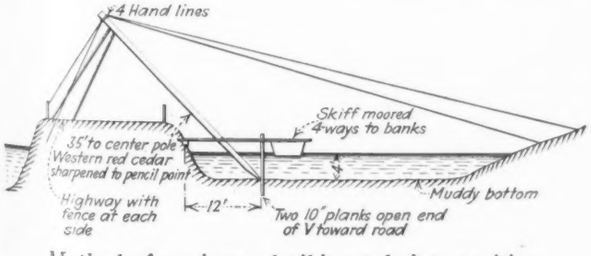
Erecting Pole in Difficult Position

By R. Philip Hart
Manager Cazenovia (N. Y.) Electric Company

IT WAS necessary to place a 35-ft. Western red cedar pole some 12 ft. from a causeway in 4 ft. of water. The bottom was heavy mud. The difficult problem was to place the butt of the pole in proper position on the bottom before raising. This was accomplished by driving two 2x10 planks in V-shape, with the opening toward the roadway. The pole was then sharpened and the end placed in the V. The planks were driven from a skiff moored four ways and connected to the shore by two more planks. With the butt of the pole in position it was piked from the bank until it could be easily raised upright by hand lines.

Pole practically erected

When once upright the pole was twisted back and forth, with two cant hooks, from the plank platform, until it had bored its way 2½ to 3 ft. into the mud. This depth was not sufficient to make it self-supporting, so head and back guys and two side guys were installed.

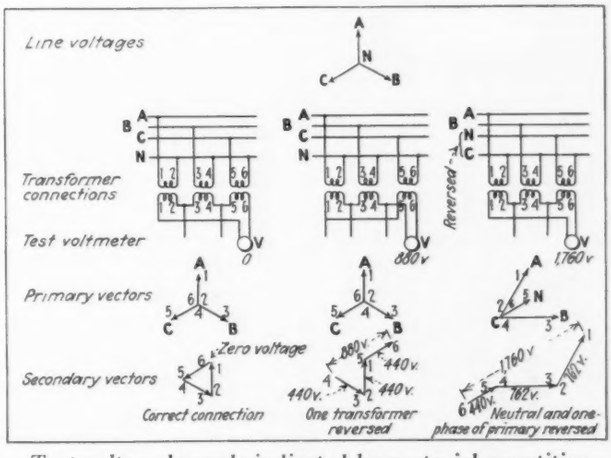

4 Hand lines
Skiff moored 4-ways to banks
35' to center pole Western red cedar sharpened to pencil point
Muddy bottom
Highway with fence at each side
12'
Two 10" planks open end of V toward road

Method of guying and piking pole into position in muddy bottom

Voltage Hazards in Checking Transformer Connections

By W. J. Lyman
Electrical Planning Engineer Duquesne Light Company

THE practice of checking the accuracy of connection of three-phase transformer banks with a delta secondary by measuring the internal secondary voltage before making the last connection to close the delta is quite general. With proper connections and the neutral on the primary side grounded (only in case of a star-delta bank) the voltmeter will, of course, read zero. A reversed transformer polarity or error in connections will result in a voltage across the open delta of twice the normal secondary phase to phase voltage.



Test voltage hazards indicated by vectorial quantities.

In making such a test on a 4,000/440-volt, star-delta

transformer bank the test voltmeter was damaged to such an extent that a voltage higher than 880 volts was clearly indicated. A careful check disclosed that although the transformers were properly connected an error had been made in marking the four-conductor, 4,000-volt cable, with the result that the neutral lead and one of the phase wires had been interchanged. The accompanying figure illustrates the possible conditions involved. Due to the $\sqrt{3}$ times normal voltage on two transformers and the unusual vector relations a voltage four times normal, or, in this particular case, 1,760 volts, will appear across the open delta.

It is evident that the frequent practice of making this test with a voltmeter built for only twice the normal circuit voltage may easily cause considerable damage and also constitutes a serious hazard to workmen.

Automatic Frequency Regulation

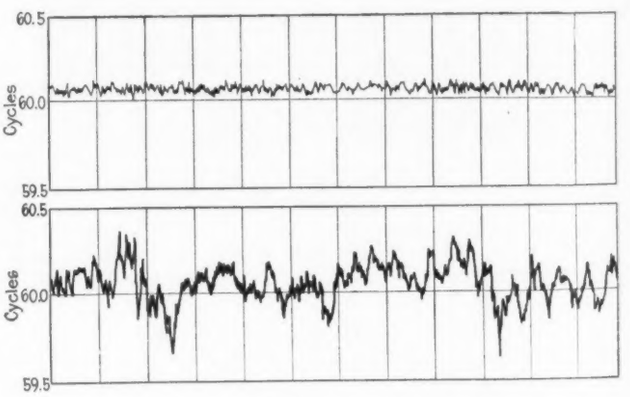
By Dean M. Thomas

Superintendent Meter and Test Department, Binghamton Light, Heat & Power Company

THE Binghamton Light, Heat & Power Company, through the courtesy of the Leeds & Northrup Company, has for several months been trying out an automatic frequency controller which so far as is known is the only similar device now in operation in a steam-generating station in the United States. The executives of the Binghamton Light, Heat & Power Company believe that the "sale of time" is not only possible but that with the proper equipment for its regulation is a big asset through the resulting good will for the company. The equipment now in use has proved most satisfactory and may be of interest to other companies selling or considering the sale of time.

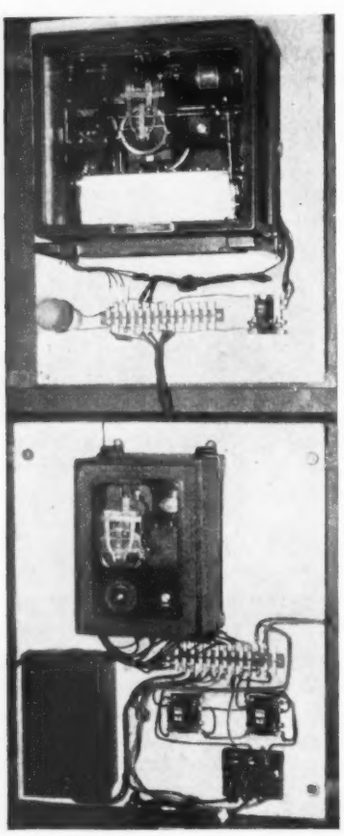
The frequency controller at the bottom of the board in the accompanying illustration is connected to the governor regulating motor on the steam turbine by means of suitable relays. It automatically sends out impulses to the governor motor proportional in time duration to the frequency deviation from the point desired. This proportional step design of the instrument prevents any tendency to hunt. The controller being adjustable, it is possible to keep frequency within close or wider limits; in the case of this company a band approximately 15/100 of a cycle is easily maintained without any apparent loss in economy in boiler room operation. This form of control has proved entirely practical.

Considerable thought was given to making the operation of the equipment "foolproof," which resulted in the use of a Leeds & Northrup frequency recorder fitted with suitable contacts, a signal light and bell alarm. Should the frequency from any cause raise or lower more than three-tenths of a cycle the automatic controller is disconnected and the operator is informed through the bell alarm that the turbine is again on hand regulation; if the supply circuit to the frequency recorder fails the signal light becomes dark and the controller is disconnected.

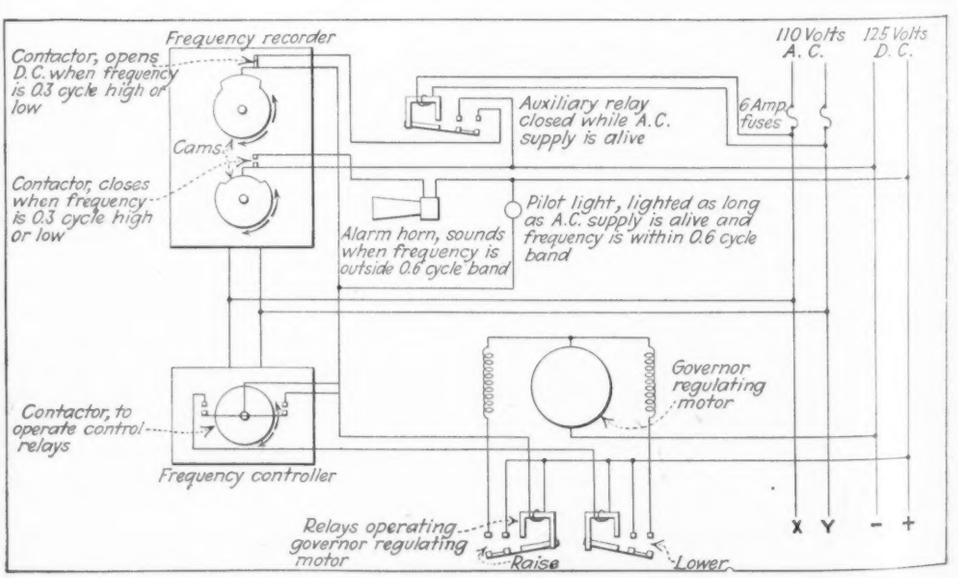


Automatic control improves system frequency

The charts show a comparison of representative frequency with hand regulation (lower) and with the controller operating (upper). The average frequency or resulting "time" is maintained by means of a Warren master clock and with automatic regulation it requires only occasional attention.



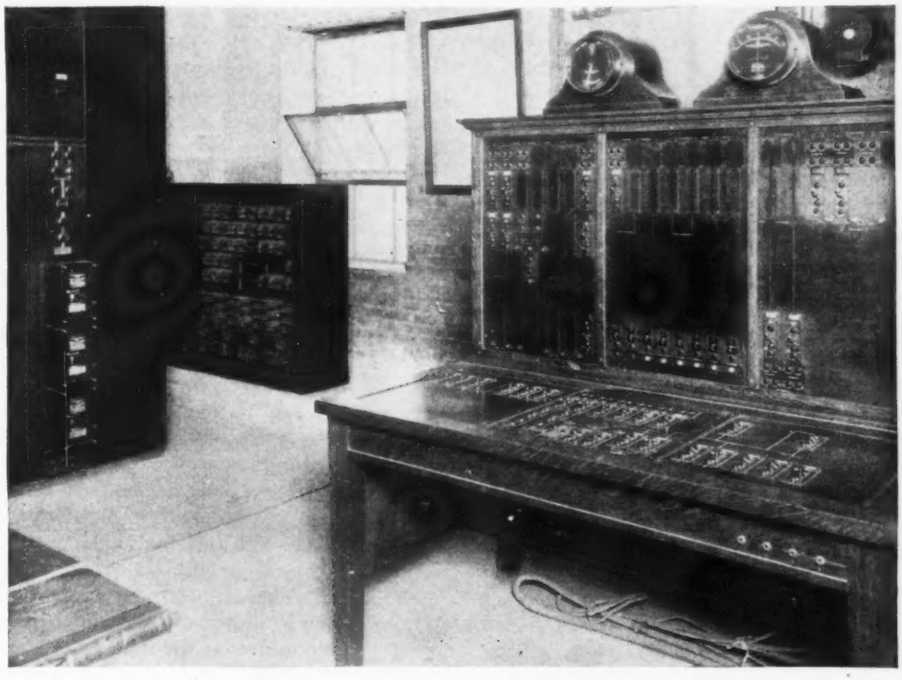
System frequency automatically controlled


Frequency recorder
Contactor, opens D.C. when frequency is 0.3 cycle high or low
Cams A
Contactor, closes when frequency is 0.3 cycle high or low
Auxiliary relay closed while A.C. supply is alive
6 Amp. fuses
110 Volts A. C.
125 Volts D. C.
Alarm horn, sounds when frequency is outside 0.6 cycle band
Pilot light, lighted as long as A.C. supply is alive and frequency is within 0.6 cycle band
Governor regulating motor
Contactor, to operate control relays
Frequency controller
Relays operating governor regulating motor
Raise
Lower
X Y
- +

Supervisory Control Succeeds

Results of operation on Staten Island electrical systems. Two independent systems controlled by one supervisory installation. Details of operations

By M. M. SAMUELS
J. G. White Engineering Corporation

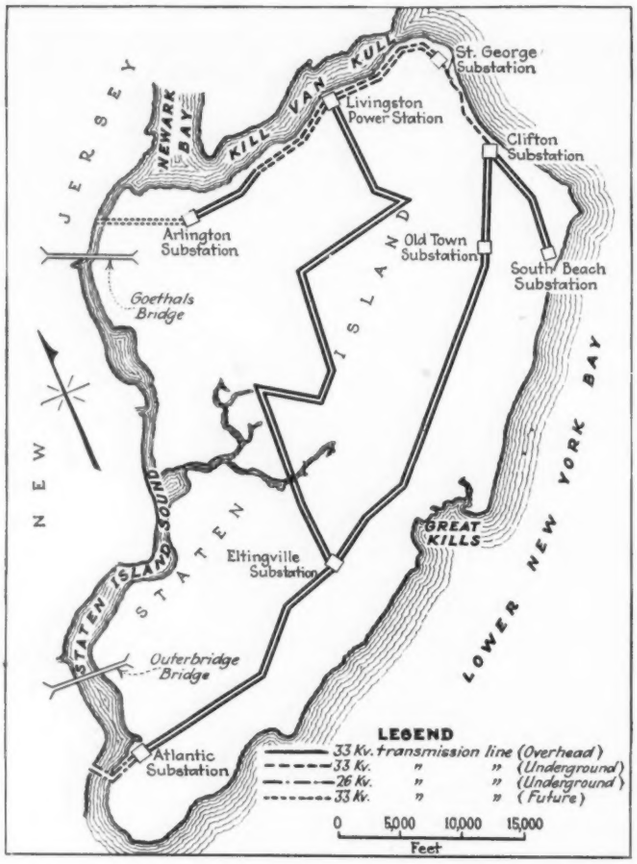


Supervisory control desk and relay cabinet of the Staten Island Edison division of the Associated Gas & Electric system

VARIOUS methods employed for supervisory control have been described in detail on a number of occasions, and it is therefore necessary only to mention briefly one particular feature which is peculiar to the system used on Staten Island. This is the fact that two independent systems are controlled over the same supervisory chain and the same supervisory wires, each system having its own control desk and its own operator, the two operators being in separate rooms, not being able to see each other or each other's control desks and being able to communicate with each other by telephone only. One of the systems is that of the Staten Island Rapid Transit Company, consisting of railway substations, the other that of the Staten Island Edison division of the Associated Gas & Electric system, supplying energy to these substations and also furnishing distribution for light and power for the whole of Staten Island.

Staten Island is New York's greatest undeveloped borough, being 13.9 miles long and 7.3 miles across its widest part, with an area of a little over 57 square miles and a population which has been growing at the rate of 30 per cent per decade. When the Staten Island Rapid Transit Company decided to electrify its system, it decided to purchase energy from the Staten Island Edison division of the Associated Gas & Electric system. The railway company decided to establish railway substations at St. George, South Beach, Old Town, Eltingville, Atlantic and Arlington. This fitted in with the ideas of the Staten Island Edison Company, which was embarking on a very extensive construction program and found that where a railway substation is required there is also required a power and light distribution station.

All of Staten Island was until then supplied by 2,300-volt and 6,600-volt circuits from the power house at Livingston, which had begun to outlive their usefulness, and it was decided, in addition to a definite program for taking care of the necessary additional turbine capacity, to establish a very efficient 33,000-volt system through the island. A double-circuit line was built from Livingston via Eltingville to Atlantic, running about midway through the long direction of the island. In addition, the plans call for a double circuit leaving Livingston in both directions, skirting the whole water front and joining again at either Eltingville or Atlantic. The greatest portion of these water-front circuits as well as the double circuit from Livingston to Eltingville are now in operation. The utility substations, which are joint stations with the railway substations, were estab-

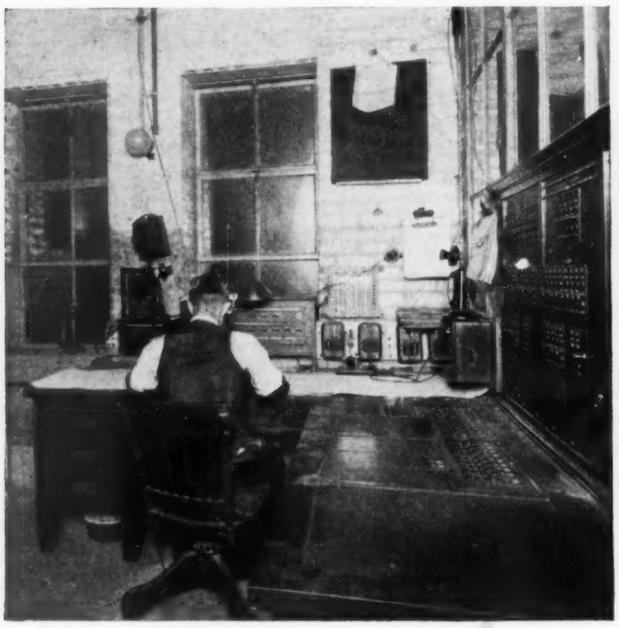


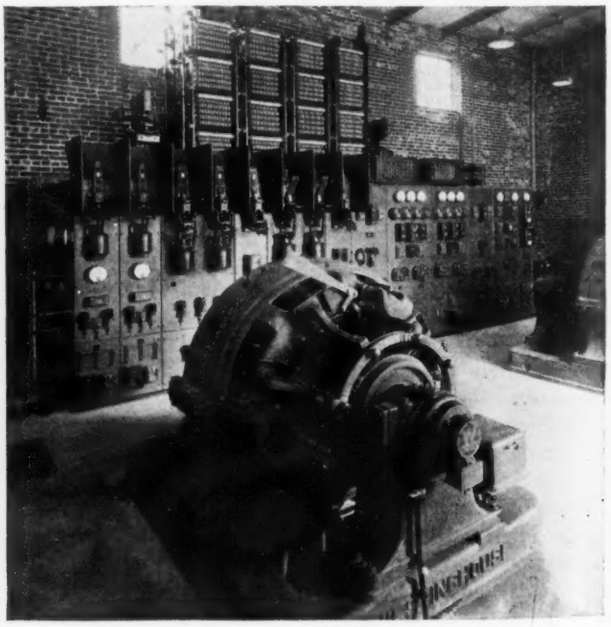
Staten Island showing locations of substations and high-tension transmission system

lished at St. George, Old Town, South Beach, Eltingville, Arlington and Atlantic, and one distribution station was located at Clifton.

The S.I.R.T. decided to make all its substations automatic as well as supervisory, the whole system being controlled from the St. George substation, where the railway dispatcher's headquarters are, and placed a contract with the Westinghouse company for all the station equipment as well as the supervisory control equipment. The Staten Island Edison expected to maintain an operator at each substation, but this appeared to be a rather costly procedure, particularly in stations containing only supply switching for S.I.R.T. equipment. The alternative of allowing the S.I.R.T. to operate the Staten Island Edison high-tension switching was considered inadvisable because this would establish divided responsibility for the 33,000-volt system of the Staten Island Edison. After various conferences with the manufacturers' engineers it was found that with small additional expense on the part of Staten Island Edison it would be possible for it to have its own control desk in a separate room and operate its switches over the supervisory chain and supervisory wires of the railway company. Accordingly a contract was entered into by the two companies, and the system has now been in successful operation for about three years. Since then Staten Island Edison has installed additional relays and its own cable to Clifton, so that this station is likewise operated from the supervisory desk at St. George. A double-circuit submarine cable tie from Atlantic to Perth Amboy was established tying the Staten Island Edison system to that of the Public Service Electric & Gas Company of New Jersey, and the necessary switching, synchronizing and instrument reading for this purpose is also accomplished from St. George over the supervisory system.

Thus the transit company controls from St. George five railway substations, each having two or three rotaries, with the corresponding high-tension and low-tension switching, as well as a number of direct-current feeders, St. George substation itself being under manual control. The Staten Island Edison now has five and will soon have six substations under supervisory control, operating a total of 49 oil circuit breakers and two motor-operated disconnecting switches. There is also a permanent lamp indication showing whether the 58 bus-selector disconnects on the 33,000-volt system are closed or open. In addition, two synchronizing circuits and two





Supervisory control and dispatcher's room of the Staten Island Rapid Transit Company and typical railway substation, automatic and supervised

meter readings are accomplished over the supervisory system. The system also supervises the control batteries in all the substations, and an alarm is given at St. George when a door leading into any substation is being opened. The saving in wages to operators is about $6,500 per year per station for each company, and the operating results have been very satisfactory.

The cost of installing supervisory control has to be checked in each case, because it involves two items, one being the supervisory control and protective apparatus proper, the other being the supervisory cable—generally a telephone cable either overhead on messenger or underground. The number of conductors in such a telephone cable has comparatively little influence on the cost of the cable installed, but the distance and construction methods will greatly affect the cost and will in most cases amount to more than the cost of the supervisory equipment.

It was originally feared that delays in operation would be caused by the fact that one operator may be using the chain when the other operator has to receive a signal or operate a switch. For instance, if a breaker on the Staten Island Edison system should trip out at a time when the Staten Island Rapid Transit operator was holding the chain, the former would not receive the alarm until the latter released the chain. However, this is only a matter of seconds, and each operator has a lamp indication when the other is operating. In practice there is no record of any such delays having occurred in the three years of operation. This certainly speaks well for the system.

The approximate annual maintenance cost, including regular periodic inspection, testing, cleaning, etc., is $200 per station, and the total cost of replacement for all stations over a period of three years was $25 for the Staten Island Edison and $168 for the Staten Island Rapid Transit, the latter cost consisting principally of "Rectigon" tube replacements.

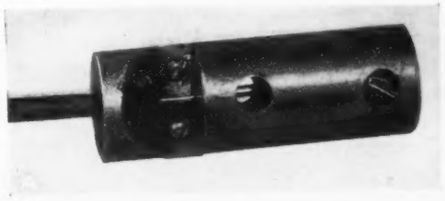
There is only one failure on record. This was due to high potential induced in the supervisory control cable by an arcing ground on the 33,000-volt supply line on the opposite side of the right-of-way. The lightning arresters on the supervisory control wires at the station were found to be defective in that they were not properly proportioned for the service. This defect has since been remedied, and no further trouble has been experienced. Thus it may be said that the supervisory control system on Staten Island has been successful beyond all expectations.

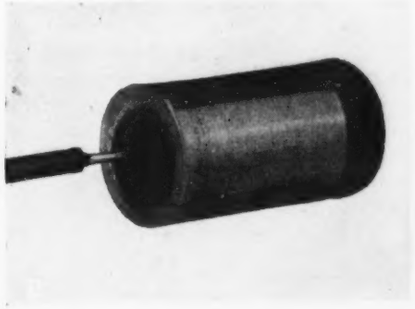
Better Meter Leads Secured at Lower Cost

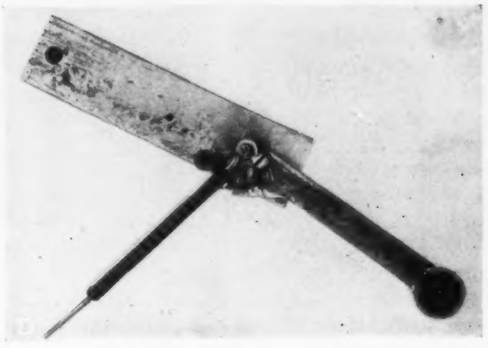
A LARGE number of pieces of wire of the same length are used as leads from the switch terminals to the terminals of electric meters by the Consolidated Gas, Electric Light & Power Company. Since the length of these meter leads is standardized, mechanical means of making them have been developed to save time and secure uniformity.

This was found necessary because several experiments with commercial wire skinners indicated that they were not adapted to this particular job, in which quantity production is a major consideration. Neither did the commercial devices perform the additional functions of cleaning the bared copper or forming the terminal loops. The equipment developed for the Baltimore requirements was designed by A. C. Leewer, laboratory foreman, and has been in successful operation for three years.

According to F. H. Rogers, meter department, a cutting head is mounted on the shaft of a ¼-hp. electric motor. As the wire is fed in a small knife makes a vertical cut spirally around the insulation, while another, set like a chisel, lifts the insulation off between the spiral grooves. The high-speed circular motion of the head effectively clears it of shavings. The bare ends of the lead are polished by inserting them in a cleaner, which consists of a brass cylinder packed with carding cloth. The cleaner is driven by a ¼-hp. motor.







A—Cutting head with two knives forms spiral groove in insulation and clears it from wire

B—Polisher cleans wire to a bright finish

C and D—"Button-hook" machine forms terminal loop

Formerly it was considered necessary to solder a lug on the switch end of the meter lead to insure a tight connection at the switch terminal, but a "button-hook" machine is now used to form a smooth hook on one end of the wire to take the place of a terminal.

Formerly one man turned out 250 leads with soldered lug in a day; now meter leads are made at the rate of 800 per hour.

Engineers Help Local Managers and Accountants

IN A large Eastern utility serving a number of small cities and many rural districts the work of local managers has been aided materially by a new engineering set-up, as follows:

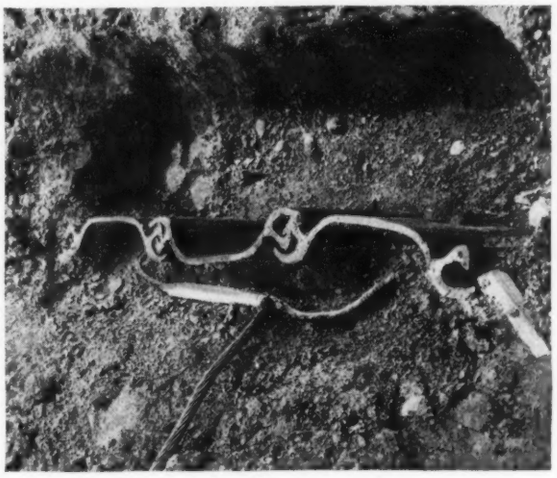
The system as a whole is divided into six divisions and the latter into districts. Each division manager is supported by district superintendents or town representatives. The division manager, who in the past was chiefly looked upon as a technical man, now devotes the greater part of his time to commercial matters and to customer relations. Of late such managers had little time to devote to plant development, and as they were unable to keep up with the demands for new construction four engineers have now been assigned to the various divisions. These men are especially qualified for their work and their duties are essentially as follows: (1) Periodical inspection of plant, with the object in view of scheduling major maintenance expenditures; (2) surveys of load densities so that the distribution mains may be at all times kept adequate for present and immediate loads; (3) the drawing up of all estimates or work orders for construction work submitted for formal approval; (4) keeping up to date all records incident to joint line construction; (5) inspection of all work in process—construction or reconstruction; (6) assisting line foremen in their daily problems by advice and counsel; (7) such other work as the operating engineer, located at the general office, may direct.

The division engineer's contact with the personnel of the division is through the division manager and superintendent, and he is expected to consult with them on all matters pertaining to that particular division to the end that they may be fully informed as to his activities, as well as to provide the division engineer with information necessary for the efficient carrying out of his duties. This engineering set-up also helps tie in field activities with the records kept by the accounting department. The accounting department has a contact with some one whose sole duty it is to see that the field activities are just and proper. In conference with the division engineer, records are now promptly analyzed and corrected before the project is completed. In this way more accurate records are kept and a better basis for future estimates is available. This organization helps secure those independent, complete and unbiased reports of expenditures authorized in the budget which are necessary to avoid waste and extravagance in carrying out the authorized work in the field and local office.

Simple Installation of Station Grounds

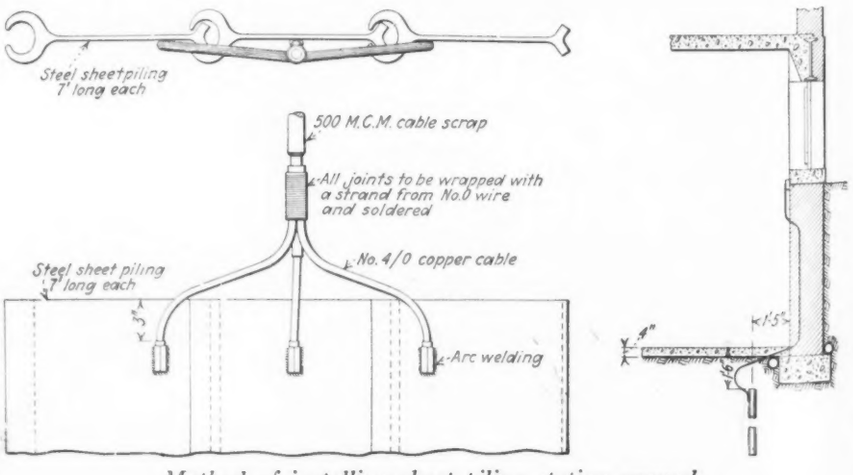
By L. H. Romzick
Detroit Edison Company, Detroit, Mich.

AT THOSE places in electricity systems where ground currents might reach high values it was the practice formerly to bury single large masses of metal and thus have the ground connection at one point. Of late years, however, the distributed ground has come into favor and it is found in most of the modern stations.



Sheet piling ground in place

A simple distributed ground, and one that was found to be comparatively cheap to install while the necessary construction equipment was on the ground, is that which is included in the addition to its Waterman substation, now being built by the Detroit Edison Company. The new addition to the present station is to be 150 ft. long and 80 ft. wide, the sides being divided into eight bays and the far end into three. While the foundations were being put in three pieces of sheet piling, about 7 ft. long and interlocked, were driven in the centers of the bays 18 in. inside the building wall. This piling was scrap material. There are thus nineteen ground points in the addition, the ground bus being mounted on the inside wall, as is shown in the accompanying illustration. The connections to the pieces of piling were made at first with rail bonds, but it was decided later that ordinary welded or braced connections were sufficient.


Steel sheetpiling 7' long each
500 M.C.M. cable scrap
All joints to be wrapped with a strand from No.0 wire and soldered
No. 4/0 copper cable
Steel sheet piling 7' long each
Arc welding
4"

Method of installing sheet piling station ground

Sustained Accuracy of Meters

Results of an analysis of records covering 24 companies having more than 380,000 meters indicate that aging affects accuracy less than does handling

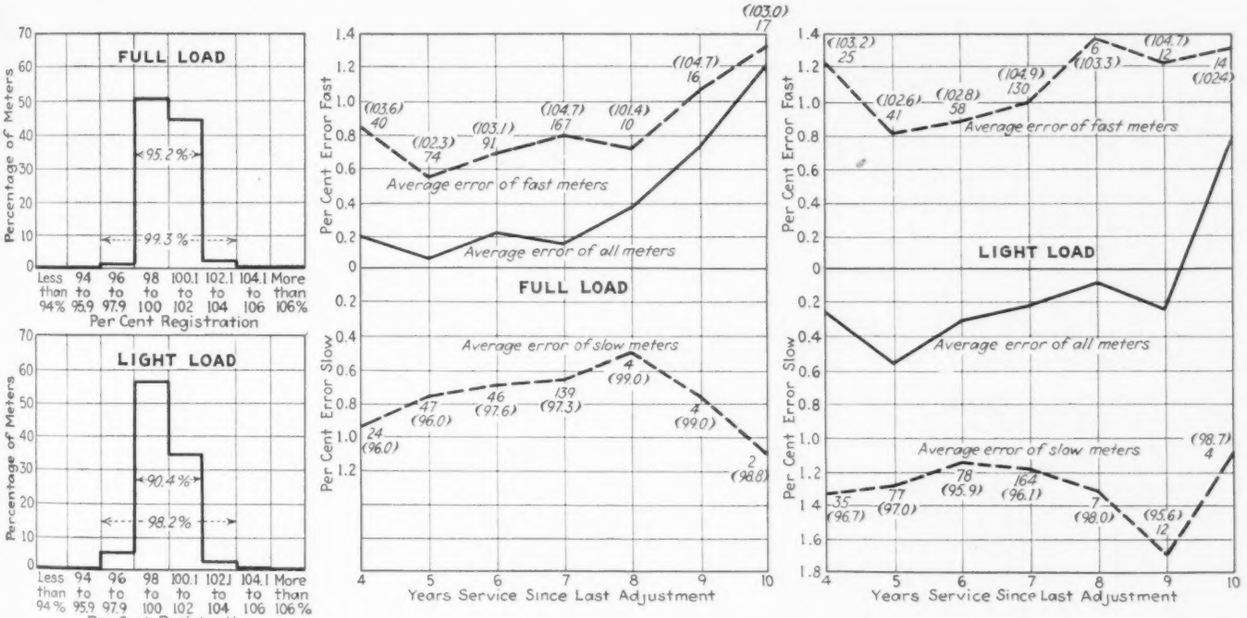
By Prof. Archer E. Knowlton

Electrical Engineer Public Utilities Commission of Connecticut

SEVERAL factors have been at work in recent years to improve the sustained acccuracy of watt-hour meters. The meters themselves have undergone a progressive development in the materials employed, the fabrication, assembly, initial adjustment and general handling. The utility companies, on the whole, have given an increasing attention to the administration and technique of their meter departments. Also some of the regulatory bodies have set up laboratories and procedure for insuring the accuracy of the master meters, and in some cases the field test meters of the utility companies. On the whole, it appears that there is ample reason for believing that the sustained accuracy of the meters has been improved and that there are progressively fewer of them that are found on periodic test to have developed errors that are outside allowable limits.

This matter of sustained accuracy has been the subject of a recent study in Connecticut and some of the facts disclosed are presented here for the benefit of those interested, and that might readily involve everybody. The statistics have been obtained from 24 companies having a total of 383,490 meters in service, of which 371,028 are single-phase meters having a current rating of meter element not exceeding 25 amp.; the latter figure, therefore, embraces the great mass of residential meters and most of the smaller commercial meters. A total of 91,639 periodic tests were made on this latter group during the year 1927 and the percentage figures reported for 1927 in the following paragraphs pertain to those tests.

The Connecticut Public Utilities Commission since 1916 has required test of the smaller meters at intervals of not more than three years. Consequently the periodic tests here presented are tests in service of meters that have been in service for some part of three years, most of them close to three-years. The practice in some cases is to use a tab system to call the meters up for test as they approach the three-year limit. In other cases the meters are scheduled on a district basis, with the result that meters installed at any time since the last periodic test in that territory are tested on the route. Consequently some of the meters will have been in service for a relatively short time if they were installed for a new customer rather recently. On the other hand, a



Results of more than 90,000 periodic tests of single-phase meters

Fig. 1—More than 99 per cent of meters came within ±4 per cent accuracy tolerance on full load.

Fig. 2—Percentage of meters falling within tolerance allowed at light load.

Fig. 3—Average error of meters, fast and slow, as determined on full load test.

The upper curve shows the average error of those meters that were found fast on full load. Adjacent to each point is indicated the number of meters involved and in parentheses the registration of the meter having the maximum departure. The lower curve shows the same for the slow meters and the middle curve the general average of all.

Fig. 4—Light-load tests of average error show wider range than on full load.

few may have been in service slightly more than three years, because even with a conscientious effort to conform to the three-year requirement premises are found locked on the first call and the second visit may fall outside the three-year interval.

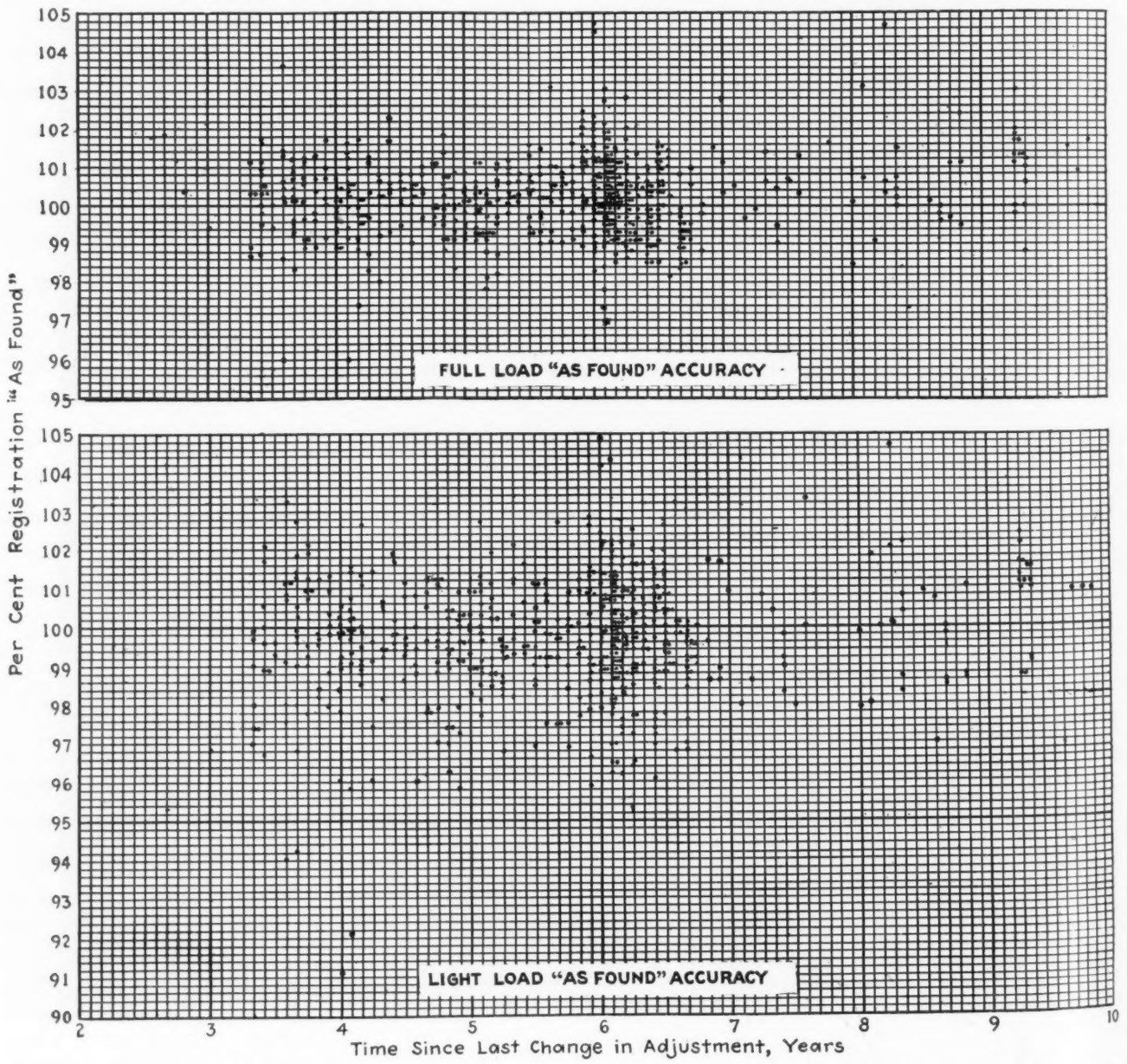
It will be seen in Fig. 1 that 99.3 per cent of the meters tested lay between the limits of 96 per cent and 104 per cent accuracy on full load. These tolerances have significance in that the statute establishing the commission stipulates that the meters shall be approved if upon formal request test by the commission they are found to have errors not in excess of 4 per cent. If the tolerance of 2 per cent is taken as a standard (as prescribed for periodic tests) it will be seen that of the 90,000 meters tested 95.2 per cent were found to lie within these limits.

To make the record fairly complete a corresponding set of percentages is recorded in Fig. 2 for the light load on the same meters. A few of the meters found slower than 94 per cent were reported as "not registering."

Analysis of the progressive drift of accuracy of meters remaining continuously in service was also made to determine the propriety of adherence to the three-year periodic test requirement. Data were obtained from one company which keeps its meter test cards in alphabetical order by streets, some 5,000 cards for the first 37 streets being scanned to select for tabulation meters that had remained in service without adjustment for two or more complete three-year periods. The full-load accuracy "as found" was then plotted on a target diagram (Fig. 5) for the 691 meters out of the 5,000 found to have remained in service for more than three years. A similar diagram (Fig. 6) shows the situation with respect to the same meters on successive light-load tests.

Average Error of Fast and Slow Meters

These target diagrams have been analyzed (Fig. 3) to determine their quantitative indications of tendency for meters to change in accuracy while in service. It



Figs. 5 and 6—Full load "as found" accuracy of 691 meters which had not been adjusted for two- or three-year periods and light load "as found" accuracy of same meters involved in Fig. 5

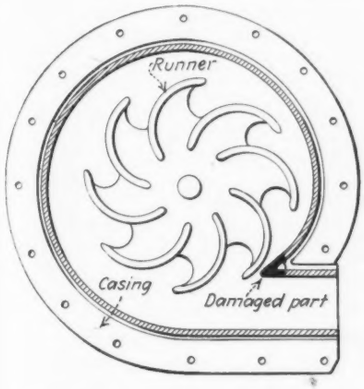
is quite evident from inspection of these curves that the meters may be considered to keep within tolerable limits of deviation for two and even three years beyond the prescribed three-year periods. This assertion has equal foundation whether based on (1) the average error of fast meters, (2) the average of slow meters, (3) the average error of all, fast or slow or even, (4) the maximum error found in either direction. It is likewise indicated that the accuracy is less stable after the seventh year; of course, the number of meters continuing in service for such long periods is rather small to support positive conclusions. It is interesting to note that the average error on full load is all on the "fast" side.

Under light load there is more spread between the average errors for fast and slow meters (Fig. 4), as might be expected. The maximum errors found for individual meters are not much different from the maximum found in the case of full-load tests. Also the average error is somewhat greater, but still not intolerable. It is notable that it lies on the slow side for all but the tenth year, where again there are, however, very few meters involved. The error decreases steadily up to the eighth year of service. It is hoped that this data may be found useful in discussions of the appropriate value of periodic test period.

On the whole, it appears that meter performance and meter department administration have been improving and that the public should have full confidence in the accuracy and precision with which its electrical consumption is being registered. It would, of course, be of interest to compare the sustained accuracy of meters remaining continuously in service with those that are removed and reinstalled with changes in customers. But even in the absence of such data it is probably safe to say that drift due to aging is far less than drift due to handling. Leaving out of consideration all matters of reduced meter department costs and prompt service and fixing attention only on the effect upon the meter itself, it appears that a better metering job is being done when the meter is left in place when the customers change at a given location.

Pump Casing Economically Repaired

By S. Hara
Maeda Power Station, Shimonoseki, Japan



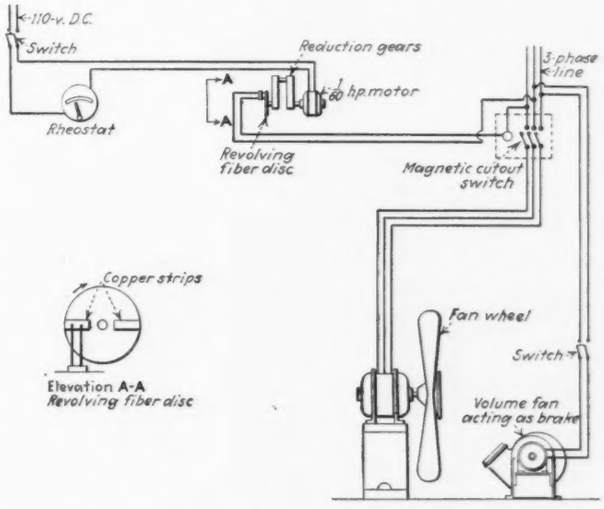
THE cast-iron casing of an impeller pump supplying sea water to the condensers in the Maeda steam-generating station became seriously damaged by the cooling water and consequently operated at low efficiency. The portion indicated in the accompanying figure (an offset of about 3 in.) was found to have disappeared upon examination of the pump casing.

A net of steel wire was welded to the damaged part and covered with concrete. This repair has proved both strong and effective and has been in place for three years without any apparent deterioration.

Automatic Control Economical in Test Work

THE life testing of propeller fan wheels, to determine the number of starts and stops that the wheel will stand, has been speeded up and the results rendered more conclusive at the plant of the Buffalo Forge Company by automatic electric control of certain devices.

In the original test set-up a three-phase induction motor was connected to the fan. An extra large motor was used so that the fan would start up quickly, a switch



Life tests speeded by automatic control without augmented strain on test part

being arranged to close the circuit for ten seconds, then open and allow the fan to stop, at which it would close again. It was found that anywhere from a minute to a minute and a half were required for the fan to come to rest after the circuit was broken. In order to cut down this "coasting" period a motor-driven fan was placed in front of the wheel as shown in the illustration, blowing against the blades and tending to bring the wheel to a stop and start it in the opposite direction. But in case the circuit operating the large motor did not close at the instant the wheel came to a stop, the small fan would cause it to run backward and bring a tremendous strain on the blades when the motor started.

A special timing device was arranged as illustrated in connection with a G.E. C.R. 7006 – D4 magnetic switch and consisting of a variable-speed electric motor and a gear reduction of 1,369 to 1, with a make-and-break-device mounted on a fiber disk at the end of the reduction unit. The speed of the small motor used on the timing device was controlled by a C. H. No. 3291 rheostat. By adjusting the speed of the motor it was possible to set the timing device so that the fan wheel on test would start up the instant it came to a stop. The use of the small fan as an air brake made it possible to start and stop the large fan twice as many times per hour as without it.

In testing 30-in. fan wheels it is possible to start, attain full speed of 860 r.p.m. and stop within 40 seconds. At this rate of 90 starts per hour the test was continued for 516 hours, a total of 46,440 starts and stops. This is equivalent to about 50 years of service under conditions assuming three starts per day, 300 days a year.

Louisville Has Successful Lamp Sales Campaign

AN AVERAGE of 62.1 watts per lamp sold was attained by the Louisville Gas & Electric Company in its recent "Fill the Empty Socket Campaign," as reported by Robert Montgomery, general sales manager of the company, in *Byllesby Management* for November. A total of 56,600 lamps with a rating of 3,519,140 watts was sold. The average number of lamps per customer was 0.952 and the average number of watts per customer was 59.2. The campaign was carried on for six weeks, with only residential electric customers within the city limits of Louisville being solicited.

It was determined to limit sales to the new style inside frosted "Mazda" lamps so as to show the public the superiority of this type. Five sizes, 25-40-50-60 and 100 watts, were selected to allow the salesmen to make definite recommendations of the right lamp for the right place. Twenty young men, most of whom are university students, were employed. They were given the name of "junior lamp salesmen," divided into two crews of ten each and put through an extensive course of home lighting, lamp information and salesmanship. In addition to the twenty "junior salesmen," two truck drivers, two crew supervisors and two clerks were assigned to the campaign. Each salesman was paid $1 a day (eight hours) and a commission of one-half mill for each watt sold. No salary was paid for half days and holidays, but commission was paid on all lamps sold. Each truck driver received $2.50 a day (nine hours) and each clerk $2 a day (eight hours). The supervisors were from the company's regular staff.

Let the Lamp Boys
fill up every empty socket
WHEN our Junior Lamp Salesman calls, let him give every light fixture in your home a thorough going over, and equip it with new Mazda Lamps of the size you need.
With proper lighting, you add charm and comfort to every room in your house—at very little cost. Always keep a supply of spare lamps on hand so that you can keep every socket properly filled. In the future, visit your electrical dealer regularly for new lamps.
Buy Mazda Lamps at the New Low Prices
Pay Nothing Down
Fill Up the Empty Sockets for Better Lighting
Louisville Gas and Electric Company
(Incorporated in Kentucky)

One of the advertisements featured in Louisville campaign

Following the course of instruction, the salesmen began solicitation on Monday morning, July 2. Half-page ads announcing that "the lamp boys are coming" were used in the daily newspapers on the Thursday and Friday prior to the start and on the opening day of the campaign.

The same routine was followed by the two sales crews each day. The supervisor and his truck driver would meet at the company's warehouse, where the truck had been loaded with lamps, and from there drive to an appointed place to meet the salesmen. The supervisor would give each salesman a basketfull of lamps and cards bearing the names of the customers on whom he should call on that trip. In addition to the customer's name and address, each card contained space to show the number and size of lamps delivered, the total amount of money due, authorization for the company to add that amount to the customer's next monthly lighting bill, signature of the customer and signature of the salesman. These cards were returned to the supervisor at the end of each trip and sent by him to the accounting department. The supervisor would make a daily report of sales based on the cards turned in to him. In the absence of the customer the card was left under the door or in the mail box to permit the customer to order by telephone or mail. No call-backs were made by the salesmen, nor were they permitted to receive any cash in payment for lamps.

RESULTS OF THE CAMPAIGN

Size	Number Sold	Per Cent of Number	Watts	Per Cent of Watts
25	4,056	7.1	101,400	2.9
40	8,128	14.4	325,120	9.2
50	2,770	4.9	138,500	4.0
60	30,262	53.5	1,815,720	51.6
100	11,384	20.1	1,138,400	32.3
Totals.....	56,600	100.0	3,519,140	100.0

The reaction of the customers was favorable from the start. They apparently liked the "junior salesmen," who wore white shirts, black ties and identifying armbands, because of their courtesy and willingness to be of help. In numerous instances the salesmen were asked to go through the house, fill all empty sockets and leave a supply of the proper size lamps for the various rooms. The customers seemed to appreciate the information about lighting and a large percentage of them were awaiting the salesman's call.

The campaign was completed on Aug. 11, having consumed six weeks. A total of 59,431 residential customers had been solicited and 16,416, or 27.6 per cent of them, were sold. The 41,646 lamps of 60- and 100-watt size represented 73.6 per cent of the entire number sold and 83.9 per cent of the watts sold. The average number of lamps per sale was 3.4 and the average number of watts per sale was 214.4.

Irrigation Only 4.2 per Cent of Crop Production Cost

IN MAKING a study of its agricultural business the San Joaquin Light & Power Corporation recently had occasion to compile data to show what proportion the cost of electrical energy for irrigation pumping bore to the total cost of crop production. Itemized crop production costs for 6,877 acres, on which were raised peaches, grapes, grain, corn, cotton, alfalfa and potatoes, were secured. It was found that the average cost of production per acre for the seven crops was $97.73 and that the average cost of electricity per acre for irrigation was $4.08, or 4.2 per cent of total production cost. Power costs were figured on the basis of an average of 3 acre-feet of water for the growing season, average pumping depth of 50 ft. and average rate of approximately 1.5 cents per kilowatt-hour.

IRRIGATION POWER COST COMPARED TO TOTAL CROP PRODUCTION COST FOR SEVEN CROPS RAISED IN SAN JOAQUIN VALLEY

Crop	Acreage	Average Production Cost per Acre*	Irrigation Power to Total Cost, Per Cent
Peaches	428	206.12	1.98
Grapes	1,504	107.12	3.8
Grain	455	25.96	8.8
Corn	50	54.87	4.6
Cotton	4,213	65.31	10.5
Alfalfa	80	66.47	7.9
Potatoes	147	158.23	2.6

*Includes land preparation, planting, irrigation, labor, cultivation, harvesting, hauling, miscellaneous expenses, interest on land investment, overhead and taxes

The Lighting of Washington Boulevard

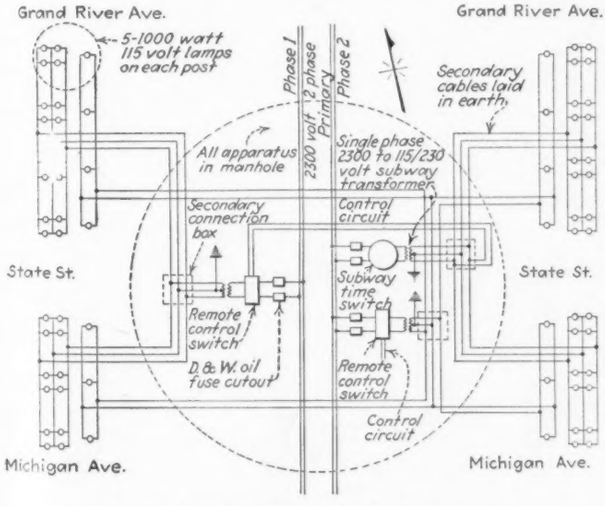
By F. MISTERSKY

General Superintendent Public Lighting Commission, City of Detroit

THE first step toward placing Detroit in the lead of American cities with well-lighted streets and brilliant "whiteways" was completed recently when the magnificent street-lighting system on Washington Boulevard was put in operation. Frank P. Book served as master of ceremonies, assisted by prominent public officials and the Detroit Symphony Orchestra. The novel and dramatic manner in which the new lighting system was turned on is described in the following enthusiastic statement made by H. V. Book:

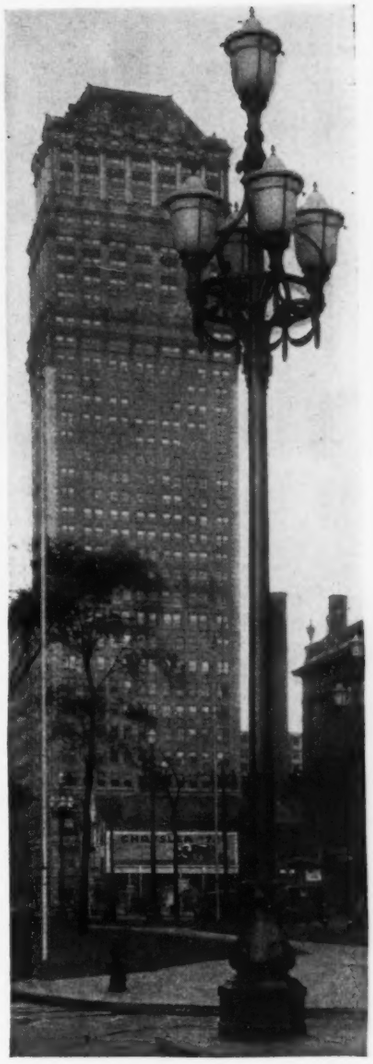
"Witnessing the spectacle from an airplane, 3,000 ft. above the street, the effect was magical. For me it was a sensation of particular significance, a thrilling consummation. Speaking through an amplifier from the plane, I directed my little niece, Mary Jane Book, to turn off the old arc lights, and a moment later to switch on the new incandescent lamp system. A gush of silver light was the response, and from the sky it at once became the focal point of all that constellation of lights that mark the city's streets. Washington Boulevard had arrived!"

The new street lighting comes as the crowning event



Control scheme of Washington Boulevard lighting

in the development of Washington Boulevard. The former lighting was fairly good, but it was not good enough. The Book Estate, which owns about half of the frontage on the Boulevard, wanted the best street-lighting system in the world, and the other property owners agreed to co-operate. The method of financing this lighting system is worthy of note. In Detroit the street-lighting expense is taken out of the regular tax fund and the money is apportioned according to the needs of the various streets. Since the Washington Boulevard interests desired a street-lighting system better than that provided by the city, the improvement association which was formed offered to pay the additional cost of installing and operating a "super-whiteway" system. The city accepted this proposal. On the opening night a decorated parchment deed which tendered the new system to the city for one penny was presented to acting Mayor John C. Nagel.



Five-lamp standard on Washington Boulevard, where 28 of these units are installed

Washington Boulevard, with its tree-covered parkway and skyscrapers on each side, is an outstandingly beautiful street. To harmonize with such a setting the lighting equipment selected is of more decorative treatment than that which is accorded for most business streets.

The lighting standards, built by the King Company, are of a special design. Ornamental cast-iron fittings, supported by an attractive steel pole, are used. The steel pole is imbedded in a steel sleeve which is placed in a concrete foundation 3 ft. wide and 6 ft. deep. The standard itself weighs more than 2 tons.

Each standard mounts five specially designed General Electric Novalux globes, 24x36 in., each equipped with a 1,000-watt, 115-volt lamp. This is the largest glassware that has ever been used for street lighting and it is the only installation in the world where five lamps of this size have been placed on a single standard. The lamps are located so that four of them are 27 ft. above the street to light center and the fifth one 33 ft. above the street.

The system comprises 28 standards in two rows along the center parkway and spaced on an average of 109 ft. apart. The light output per standard—105,000 lumens—

Washington Boulevard before and after installation of new lighting system

is more than any other existing installation, even exceeding the famous installation on State Street, Chicago, by 15,000 lumens. The illumination from the new lighting is twenty times greater than that provided by the old system. No wonder, therefore, that when the system was first turned on a great cheer arose.

The new lighting system is supplied with power from a multiple system employing two centers of distribution. The transformers and control apparatus are located in manholes. The primary is two-phase, 2,300 volts, which is stepped down to 115 volts. The upper lamp is on one circuit and the four lower lamps on another circuit. The upper lamp burns all night and is turned on and off by a remote-control switch which is operated on the regular street lighting circuits. The four lower lamps are controlled by a time switch which turns them off at midnight. The circuits are all balanced as closely as possible so that the voltage drop is about the same for each unit, and the entire load is balanced on the two-phase supply.

Not only has Washington Boulevard "arrived" but it also marks the beginning of better lighting on other streets in Detroit. Plans for relighting several of the main business streets have been made and contracts for relighting Woodward and Griswold Avenues have already been let.

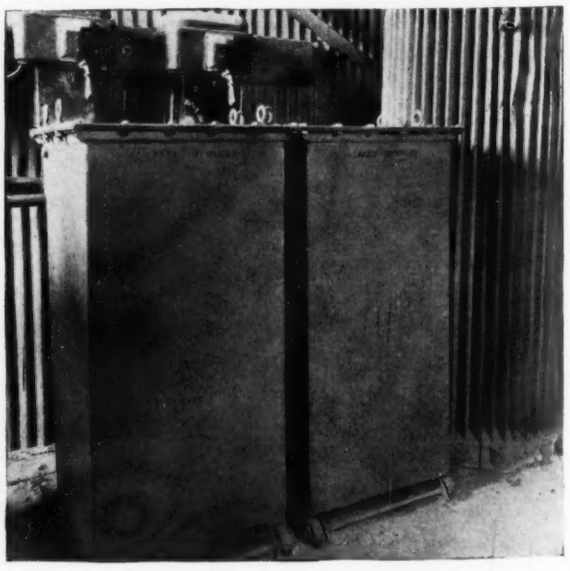
Capacitor Saves Investment in Additional Transformers

By Homer W. Forschner
Engineer Electric Machinery Manufacturing Company

THE Duquesne Slag Products Company of Bessemer, Pa., uses induction motor drives for grinding and crushing machinery, with the result that the plant was operating at a power factor of approximately 0.55. A connected load of 400 hp. was being supplied by two 200-kva. open-delta-connected transformers, giving them a substation capacity of 340 kva. The transformers were greatly overloaded as a result of the low power factor. It was decided to correct this situation by the installation of a 240-kva. capacitor. The results of this correction are as follows: (1) The power factor was raised from 0.55 to approximately 0.90; (2) the transformers were so relieved that it was possible to add an additional load of 165 hp., which was required for expansion purposes, without increasing the size of the plant transformer bank; (3) the plant voltage was increased from 215 to 242 volts; (4) an average saving in power costs of $115 per month was effected. In this instance the addition of the needed 165 hp. motor load would have necessitated an increase in transformer capacity of at least 200 kva. if the power factor had not been improved by the installation of the capacitor. Using $6 per kilovolt-ampere as the cost of increasing the plant transformer capacity, a saving of $1,200 was made.

An interesting point in this installation was the saving made to the Duquesne Light Company. This company supplies power to the Duquesne Slag Products Company through a 300-kva., 22,000 to 2,200-volt transformer substation. If the capacitor had not been installed it would have been necessary to enlarge the substation, to remodel the 22,000-volt switching equipment and to purchase additional space for the expansion.

This capacitor will pay for itself in approximately three years by the savings in power cost to the consumer alone. It made unnecessary an immediate expenditure of $1,200 by the Duquesne Slag Products Company. It has increased plant production by raising the voltage and hence bettering the operating characteristics of the motors. In addition it saved the power company a costly substation expansion.



Capacitor for power-factor correction at plant of Duquesne Slag Products Company

Utility Commissioner Urges
Holding Company Regulation

Wants control over relations between operating and holding companies because of latter's influence and charges for service. Urges uniformity of state regulation laws

JOHN F. SHAUGHNESSY*

IF THE present system of private operation of utilities under state commission regulation is to survive authority must be vested in the various commissions to regulate in some manner the practices of so-called "holding" companies, or subsidiary companies or firms, or individuals, which control in whole or in part the operations, financing and construction of utility companies by ownership of voting stock or otherwise. These parties, hereinafter referred to as holding companies, are ordinarily not the subject of regulation by the state commissions except in a limited and indirect manner. The regulation possible under present conditions goes only to an examination of operating expense accounts of the subsidiary in an effort to determine whether or not the charges made by the holding company to the subsidiary are just and proper operating expenses. In some cases it has been impossible to secure complete data upon even this phase of the relationship. The local state commission has no authority to investigate security issues by the holding company, or control its practices in any manner. As illustrative of this lack of control attention is directed to various state telephone rate cases where the company involved is a subsidiary of the American Telephone & Telegraph Company. In a recent decision of the Supreme Court of the United States[1] it has held that the state commission may not adopt the functions of the management and that the contract with the parent company would not be disturbed unless a clear showing is made of fraud practiced by the parent company or a clear showing of undue influence exerted upon the officers of the subsidiary company to induce or influence them to enter into the contract in question.

John F. Shaughnessy

A proceeding now pending before the California Railroad Commission brings this situation sharply to the attention of the state commissions. The Pacific Telephone & Telegraph Company, a subsidiary of the American Telephone & Telegraph Company, applied for increased rates in San Francisco and certain contiguous territory. The interested communities demanded that the American Telephone & Telegraph Company's books be produced to justify the expenses of the local company covering payments to the parent company. At first the parent company refused to appear or produce the books and records, although requested to do so by the local company. Later, a modification of the so-called 4½ per cent contract was made, whereby the telephone and other instruments were sold outright to the subsidiary and the payment reduced to 2 per cent to cover managerial, financing and other holding company services. Following this modification of the contract certain officers of the American Telephone & Telegraph Company appeared as witnesses at the hearing, but, according to press reports, refused to testify as officers of the American Telephone & Telegraph Company. They insisted that their appearance was purely on behalf of the subsidiary, the Pacific Telephone & Telegraph Company. According to these same reports they also failed to make a frank statement of the relationship of the local company to the parent company and withheld certain vital information. This attitude on the part of the holding company threatens the future of state regulation of privately owned and operated utilities and furnishes ammunition for the public ownership advocates.

Benefits of Holding Companies Indisputable

There are without doubt benefits to be derived by the public from the operation of large holding companies, controlling a number of utility companies. The principal advantage is in the ability of the small utility to finance its new construction and additions and betterments at lower cost for quantity purchase of materials and at moderate rates of interest through the medium of the holding company. The holding company, with its many companies and activities, is able to maintain a staff of experts in every line of public utility endeavor; auditors, engineers and finance experts. These experts would not be available to any one small company except at prohibitive cost. Through larger purchases of materials and supplies, the holding company should be able to secure better prices for the subsidiary. The holding company is also

**Chairman committee on capitalization and intercorporate relations, National Association of Railroad and Utilities Commissioners. (Address before association's annual convention.)*

[1] *S. W. Bell Tel. Co. vs. Missouri, 43 Sup. Ct. Rep. 544.*

able to maintain an organization for the construction of utility properties, which should effect economies in the cost of new construction for subsidiaries.

All of the above benefits should theoretically accrue from the operations of large holding companies. There can be no doubt, however, that some abuses have been practiced. It is also true that in many cases the public has received no benefit whatever from the economies effected.

Economies Should Benefit Public

A recent decision of a federal district judge[2] calls attention to the fact that regular payments were made by a subsidiary company to its holding company, covering services as outlined above, and in addition certain construction was done by the holding company for the subsidiary. However, under the confiscation theory in a rate proceeding, the utility took no account of the presumed economies in cost of materials and supplies and construction costs, but based its appraisal on current market prices at the point of construction and added the regular engineering and other overhead costs to the physical value. If the public is to receive no benefit from the economies effected by the holding company the service is of no value, and public sentiment will demand the discontinuance of the holding company method of control.

Holding companies have also recently engaged in a scramble for control of operating utilities, and ridiculous prices have in some instances been paid for properties which serve as a basis for security issues by the parent company. This practice must eventually react to the detriment of the utility industries as a whole. Some of these inflated stocks are bound to be purchased by innocent persons under the impression that they are authorized and approved by various state commissions.

A holding company may control large investments in public utilities by a comparatively small investment in voting stock of one utility and through this one utility control others.

Whether justified or not, an adverse public sentiment has been aroused against holding companies which is exerting an unfavorable influence against private operation of public utilities under state regulation and the trend is toward federal control.

It has always been the consensus of opinion of this association that continued private operation, under the regulation of state commissions, is the best possible method of handling public utilities. Nothing has occurred basically which should change that view. It is merely a matter of working out a problem connected with state control rather than the abolition of it and the substitution therefor of added federal supervision over purely local matters. There is the alternative of strengthening state regulation or of the centralization of control in some federal department. The latter should not be considered unless it becomes absolutely necessary.

In order to cure the present situation, full co-operation of all state-regulated utilities is required. State commission laws should be amended to give jurisdiction to all state commissions over security issues of utilities in their respective states, and the state commissions should be given authority to require the production of all records of the outside holding company which bear upon the relationship of that company to the local utility.

In short, holding companies should be defined as "public utilities" and be made subject to such regulation as may be necessary. The committee appreciates that mere legislative enactment will not make a public utility of a corporation that is not in fact a public utility. We believe, however, in all instances, where the holding company and its subsidiaries affect the control and activities of the operating company they may, and should, be considered as public utilities in fact. It is believed that practically all utilities desire a continuance of the present system of regulation, and it is therefore incumbent upon them to use every endeavor to avoid a situation which may result in a public demand for a change. Moreover, it is believed all utilities that favor effective regulation will recognize the necessity for such amendments.

We indorse and recommend the passage of uniform state regulation laws in line with the Wisconsin commission act, as explained by Chairman Lewis E. Gettle before the Senate committee hearing on the Walsh resolution (S. Res. 83), Jan. 16, 1928, when among other things he said:

> Grants are made under the water power law quite similar in many respects to the federal power act, and include a provision for recapture at the price fixed by the commission at the time of the development of the power, after 30 years' use by a public utility or a private owner either. In that there is no franchise value recognized. When a power company makes application to the Wisconsin commission for authority to build a dam, or a permit to build a dam, it is compelled to sign a waiver of any claims in the future for franchise value or any other value, except such as may be fixed by the Wisconsin commission, and that value excludes what is popularly known, and perhaps technically known too, as raw water power value. And that principle has just been decided by the United States Supreme Court as being tenable, and the United States Supreme Court sustained the Wisconsin Supreme Court in that finding.
>
> I might add that our commission decided the case originally on that principle, and that we were sustained by the Circuit Court of Appeals, and that the power companies appealed and we were sustained by our own Supreme Court by an equally divided court, and then we were sustained unanimously by the United States Supreme Court. Our commission really made the fight and laid down the principle on which tremendous savings in future rates predicated upon water power values will be effected.

Should Regulate Security Issue

Only a very few states regulate water power, and but one-half of the states regulate the issuance of stock, bonds and securities, and confine their issuance to a definite public utility purpose. This we believe should be done for the purpose of preventing speculation in the public utility field, and to prevent unwarranted growth in unearned increment values.

There may be a division of opinion among the members of this association regarding the purpose of public utility regulation. In other words, has the public utility commission done all it is or should be required to do when it has protected the consuming public to the best of its ability, or should it go further and endeavor to protect the investing public from speculative and unsafe securities? Of course, commissions, which now have jurisdiction over the issuance of securities by public utility corporations, do perform this function for both the investing and consuming public in so far as the securities of public utilities under their jurisdiction are considered. However, the public may still purchase the securities of a holding company under the impression that they are authorized and approved by the state commission, when in fact they are not. But as to the effective regulation of rates and services and the determination of the rate base, no holding company, as herein defined, can be permitted to intervene and by duplicate charges or the equivalent thereof adversely affect the

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[2] *Idaho Power Company vs. Thompson, 19 Fed. (2nd Series) 547; P.U.R. 1927D, 388.*

reasonableness of the value and the rates. This degree of protection is elementary, and we may not temporize in meeting it. The regulatory statutes of each and every state must be made definite and certain on this point.

The investigation now under way before the Federal Trade Commission has created a public sentiment which justifies all state commissions in adopting a uniform plan for the purpose of meeting the demand for the remedial regulatory legislation herein referred to.

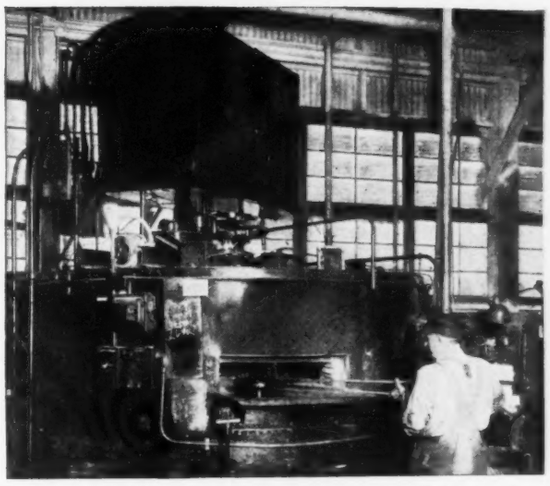
Rejects Avoided by Electric Annealing and Tempering

By C. H. Christensen
Engineering Department,
Caterpillar Tractor Company, San Leandro, Calif.

ELECTRIC heat-treating furnaces providing closer temperature control, more uniform heating and less scaling of work have resulted in a better product and have avoided rejects in the factories of the Caterpillar Tractor Company. Expensive handling charges have been reduced because the electric furnaces could be placed in the direct line of production.

The company operates a number of electric furnaces of various makes at both San Leandro, Calif., and Peoria, Ill. In the San Leandro plant are: (1) A 48-in. pusher type annealing furnace installed in February, 1928, (2) a pusher type temper-drawing furnace placed in operation in July, 1926, and (3) a rotary hearth furnace installed in February, 1928. These three particular furnaces and also many of the others were built by the Caterpillar Tractor Company and are equipped with General Electric heating elements and automatic control panels and Leeds & Northrup temperature instruments. The 48-in. pusher type annealing furnace used for annealing various steel forgings consists of a heating chamber with a capacity of one tray and a cooling chamber holding four trays, the trays being 48 in. square. The furnace operates on 220 volts, three phase, and has a connected load of 150 kw. Usual operating temperature is between 1,420 and 1,620 deg. F.

The weight of a charge exclusive of tray, which weighs 275 lb., varies from 2,000 to 4,200 lb. and the time per charge from three to five hours, depending upon the size and shape of forgings. A charge of track links, as shown in one of the accompanying illustrations, weighs 2,270 lb. net and requires 2.73 hours in the heating chamber. The consummation is 263 kw.-hr., which, at a cost of 1 cent per kilowatt-hour, makes the total cost for energy $2.63. On a poundage basis this would be equivalent to 8.7 lb. per kilowatt-hour, or a cost of $1.16 per 1,000 lb. of material.

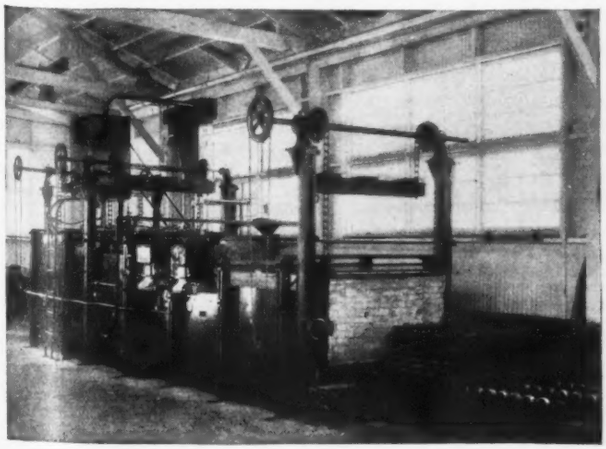


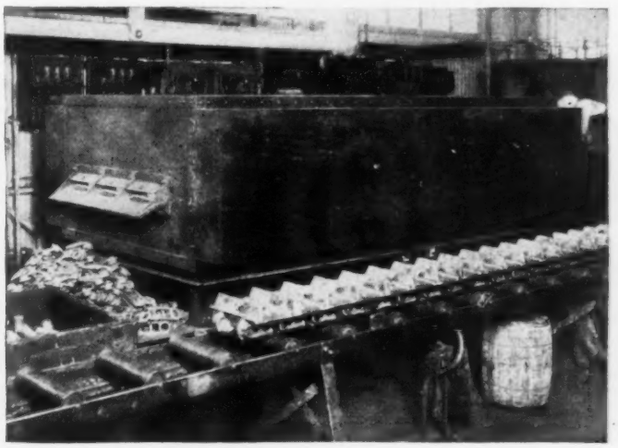
Working conditions in tractor factory greatly improved by installation of electric furnaces

This 120-kw. special rotary-hearth hardening furnace was built by the Caterpillar Tractor Company for use in its California plant.

The pusher type temper-drawing furnace was built especially for tempering track links. It is 7 ft. wide by 17 ft. long, has a connected load of 80 kw. and a normal operating temperature range of 700 to 900 deg. F. Heaters are divided into two zones, each with recording temperature controller. Operating at 850 deg. this furnace is turning out 4-lb. links at the rate of 122 per hour, or a total weight of 488 lb. per hour. Consumption per hour is 30.2 kw.-hr., or 16.2 lb. of material per kilowatt-hour. At a rate of 1 cent, energy cost is 62 cents per 1,000 lb. of steel treated. The high output of this furnace is due to the links being quite hot when fed into the furnace, having just previously passed through the hardening furnace.

The rotary hearth furnace is of a less common type than the others and is used for heat treating and hardening various steel parts. The furnace has an outside diameter of 9 ft. 8 in., a hearth 21 in. wide and a connected load of 120 kw. Heaters are on two-zone control,





Pusher type furnaces prove advantages

(Left) The track links are at outlet of 150-kw. annealing furnace. (Right) Temper-drawing furnace, 80 kw., has energy cost of 62 cents per 1,000 lb. of steel treated at 1 cent per kilowatt-hour.

the temperature of the ingoing zone being controlled by a Leeds & Northrup non-recording instrument and that of the outgoing zone by a Leeds & Northrup recording instrument. Temperature range is from 1,400 to 1,600 deg. F. Operating at 1,420 deg., heating solid round bars $1\frac{7}{8}$ in. in diameter by $12\frac{1}{4}$ in. long and weighing $9\frac{3}{4}$ lb. each, the output of the furnace is 58 bars per hour, or a weight of 565 lb. Energy consumption is 56.3 kw.-hr., or 10 lb. of steel per kilowatt-hour. At 1 cent per kilowatt-hour this is $1 per 1,000 lb. of steel treated.

On a different tractor part weighing 3 lb., 120 parts per hour are being treated, or 360 lb. per hour at a temperature of 1,440 deg. Consumption is 45.5 kw.-hr., or 7.9 lb. of steel treated. The higher cost on this latter run is due to the furnace door remaining open instead of being closed, as in the former run, and also due to lower output rate.

If compared on a fuel basis only the electric energy costs for the three furnaces would be higher than fuel oil. But when the cost of the finished usable product is considered, which is the determining factor in any manufacturing process, the electric furnaces have been found to compare most favorably with oil or gas, and, moreover, they have some collateral advantages that cannot be expressed in dollars and cents, most important of which is uniformity of product.

Letters from Our Readers

The Series Capacitor

To the Editor of the ELECTRICAL WORLD:

I have noted the editorial in the Nov. 10 issue of the ELECTRICAL WORLD entitled "The Series Capacitor." There is a mistaken view expressed in this editorial. The name "Protective Equipment" is probably confusing. Dielectric, such as is used in series capacitators, will withstand momentary voltage applications of approximately fifteen to thirty times the normal rating. Thus, without the protective equipment, the capacitor, in all probability, will not fail on system disturbances. The protective equipment limits the short-circuit current to the same value as would result without the series capacitor; that is, by the compensation of the inductance of the transmission line and transformer, the impedance of the circuit is lowered, but the protective device instantaneously removes the series capacitor from the circuit, thus retaining the advantage of limitation of short-circuit current by inductive reactance.

In fulfilling the current-limiting function the protective equipment also limits the potential rise which can occur across the capacitor. This is a desirable feature, but should not be confused with the other feature which the protective equipment accomplishes. Neither is the protective equipment complicated; it consists of a simple spark gap connected around the capacitor and a short-circuiting contactor connected around the spark gap. The impression of elaborateness may come from the automatic auxiliaries mounted as an integral part of the equipment. Such relays, in the past, have been mounted on a switchboard inside the station, but for convenience and compactness the series capacitor, with protective equipment and automatic control, is complete in itself. There are no other necessary auxiliaries inside the station.

T. A. E. BELT.

General Electric Company,
Schenectady, N. Y.

Complete Peak Method

To the Editor of the ELECTRICAL WORLD:

Constantine Bary, in a letter which appeared in the ELECTRICAL WORLD, Oct. 6, 1928, in discussing the "complete peak method" declared "the principles involved are quite erroneous" and that the method "disregards entirely the fundamental physical and economical relations which determine capacity cost." Mr. Bary claims the method "fundamentally places the allocation of capacity costs on a kilowatt-hour basis." The writer believes Mr. Bary does not understand the mechanism of the method because the method weighs peak responsibility, actual demands, the time of day such demands occur, provided the demand is during those hours of the day that the system load is above the average hourly load, and the kilowatt-hours. Consequently, the method does not "fundamentally place the allocation of capacity costs on a kilowatt-hour basis" and Mr. Bary has failed to furnish a satisfactory reason for a condemnation of the method.

Mr. Bary's comments do, however, raise a very pertinent question, namely, "What are the fundamental physical and economical relations which determine capacity costs?" According to the writer's conception, "installed capacity alone determines capacity costs." Unit installed capacity cost, however, is of little or no value for use in the allocation of costs, hence other units must be employed.

Capacity is installed to meet the requirement of the coincident demands, or plant demand, hence peak responsibility (notwithstanding Mr. Bary's criticism of "peak responsibility methods or any other glorified derivation thereof") is a useful measure. It cannot, however, be used blindly or as the exclusive measure without, as Mr. Bary and others have pointed out, inconsistent results.

There is a definite relation between the sum of the individual demands and plant demand during any allocation period, hence individual demand is related to plant demand and becomes a useful unit, but it cannot be used blindly or as the exclusive measure without inconsistent and dangerous results, except where there is no diversity, which is a rare condition.

The kilowatt-hour is a measure of used capacity and is a useful unit, but it cannot be used as the exclusive method of allocating capacity costs without inconsistent and dangerous results, except where a 100 per cent power plant load factor can be obtained without resort to controlling diversity.

Peak responsibility, demand and kilowatt-hours are practical units for use in allocating capacity costs and for providing an acceptable and satisfactory "complete method" of allocating such costs. A "complete method" must employ at least two methods, one of which may be styled an "arbitrary method" and used for allocating capacity costs to "controlled diversity" classes by giving due weight to peak responsibility, demand, kilowatt-hour and the value of the restricted service, and the other would be a fixed method for allocating capacity cost to "uncontrolled diversity" classes and to uncontrolled diversity consumers of both "controlled and uncontrolled diversity" classes, which consumers comprise in number over 99 per cent of normal utility business. The writer has offered the "consumption and demand method" for such purpose.

W. J. GREENE,
Rate Engineer

Iowa Railway & Light Corporation,
Cedar Rapids, Iowa.

Digest of Electrical Literature

Generation, Control, Switching and Protection

The Longford Generating Station of the Coventry Corporation.—The limited amount of water available for cooling purposes in certain parts of central England and particularly at the location of the new Longford generating station requires that cooling towers be used and at this plant an unusual type of concrete tower has been constructed. A steam pressure of 325 lb. per square inch and 700 deg. F. temperature is developed at the boilers. Each unit is designed for a normal evaporation of 60,000 lb. of steam per hour with a provision for 25 per cent overload. Chain grates are used. The turbo-generators are two in number and of 20,000 kw. rating each. The circulating water is taken to the cooling towers by means of 33-in. diameter steel pipes laid in a concrete trench. After being cooled the water is returned to the main suction culvert. The ultimate capacity of the site is 100,000 kw. and the circulating water system has been designed for that requirement. The necessary make-up water is obtained from the canal and is taken into the suction culvert at the end remote from the cooling towers through a screen chamber. The normal capacity of each of the four towers is 528,000 gal. per hour, but the cooling effect is good for quantities between 300,000 gal. and 1,250,000 gal. The range of cooling is 17 deg. F. The diameter of each tower at ground level is 100 ft. and the height is nearly 100 ft.—*Engineering (England)*, Nov. 2, 1928.

Transmission, Substations and Distribution

Experimental Representation of Low-Frequency Surges in Large Interconnected Electrical Systems by Means of Equivalent Networks. — VLADIMIR KARAPETOFF. — The determination of surges of energy and of speed fluctuations among synchronous machines connected to a complex electrical power system have been considered from the theoretical viewpoint of an assumed system. The various factors entering into the situation have been evaluated and the characteristics of the various elements of the system fully considered. The latter include the synchronous generator or motor, centrifugal governor, a group of synchronous machines connected to an infinite bus through an impedance, two groups of synchronous machines connected by a transmission line, stationary loads and combination network. An exposition of the principal of duality has been included. It is stated that several factors determine the oscillations of a synchronous machine about its average angular velocity. These are periodic energy storage in its revolving part due to changes in kinetic energy, excess in synchronous torque, non-synchronous interchange of energy between the rotor and stator due to the damper winding an unbalanced force applied to the rotor, and supplementary losses due to hunting, the effect of which it any is to make the oscillation less pronounced.—*Sibley Journal of Engineering*, October, 1928.

Residual Voltages and Currents in Power Systems.—L. J. CORBETT.—In the problem of inductive co-ordination of power and communication systems, residual voltage and currents in the power lines are important elements, yet they are not, according to the author, well understood. Studies have been made and others are well under way by well-equipped organizations which add much to the data concerning these factors. In this discussion the general principles which apply have been reviewed briefly and their relation to typical power circuits and networks pointed out. Oscillograms verifying the theories developed by the author have been included.—*Journal of the American Institute of Electrical Engineers*, November, 1928.

Units, Measurements and Instruments

The Geometry of Resonance Diagrams.—J. K. CATTERSON-SMITH.—One of the most widely used methods for measuring the high-frequency resistance, or power factor, of an efficient circuit, such as is used for radio transmitters, is that in which the decrement is found from the resonance curve obtained from measurements. It is a simple matter, according to the author, to measure in the laboratory the current flowing in a circuit adjusted to be in resonance with the applied frequency, and if this is altered and the values of the current plotted to a frequency abscissa scale the resulting graph is a resonance curve. The author has outlined the mathematical considerations involved in the development of such charts and has analyzed the properties of resonance curves and of dissonance diagrams.—*Engineering (England)*, Oct. 5, 1928.

Some Developments in the Routine Pressure-Testing of High-Voltage Cables.—E. A. BEAVIS.—The difficulties experienced in connection with cable ends when testing at high voltages in air are dealt with, and the reason for preliminary sparking at the lead sheath and its tendency thereby to produce spark-over are explained by the author. Various methods in normal use for overcoming this disadvantage are noted and have been fully described. A suggestion is offered for the use of semi-conducting material as a temporary method of attaining greatly improved results for ordinary routine testing work. Comparative results are given both in tables and curves, indicating the advantages obtained by using semi-conducting carbon paper applied in various ways on or over the surface of the cable insulation. Theoretical lines-of-force diagrams are shown to explain these results and indicate in what manner they are produced, and these contentions are supported to some extent by practical measurements. Fusing-current tests have been included for various samples of the material, and in view of these a possibility of the more permanent use of the principle is suggested in connection with the installation of insulators, bushings and similar items of equipment.—*Journal of the Institution of Electrical Engineers (England)*, October, 1928.

Illumination

Hours of Municipal Street Lighting.—EDGAR DOW GILMAN.—An analysis of the hours for street lighting service in various communities, with particular reference to the requirements of the city of Cincinnati undertaken to determine more exactly the hours when such service is needed and to develop a more rational basis for its supply. The governing conditions on which judgment in making schedules must be based have been developed upon a detailed analysis by the author. Costs of street lighting have been introduced. As a result of these studies new schedules are being prepared for the city in question which will hold the times for turning on and off the lights closer to the end and beginning of the "civil twilight." It is stated that modifications in existing contracts to permit of variation from the schedules on dark days and to light the business area for a greater number of hours than the residence area will be put in effect.—*Engineering News-Record*, Nov. 1, 1928.

Heat Applications and Material Handling

Economic Speed of Paper-Covering Machines.—R. BUHK.—Round and rectangular copper wires used for cable manufacture or for the windings of electric machines are insulated with two or more layers of paper ribbon, for which process motor-driven paper-covering machines have been developed, which provide in one passage ten or more layers of paper. The article deals with the problem of how to choose the speed of covering to reach a maximum of economy. Every time a paper roll has been emptied the machine has to be stopped to put a new roll in its place. The ratio of roll diameter and speed of rotation, together with the energy consumption per stage and the hourly pay of the attendant, are determining fac-

tors of the economy of the process. These values are made the basis of a theoretical investigation leading to a formula for the most economic operation of paper-covering machines.—*Elektrotechnische Zeitschrift,* Oct. 4, 1928.

Mass Production Welding Operations.—JOSEPH W. MEADOWCROFT.—The various methods used on all-steel automobile bodies for welding operations have been outlined in this discussion, together with a record of the advances in the art in recent years. This industry has been particularly active in developing improved practices, since welding constitutes such a large proportion of the shop work. The oblique welder prevents surface markings, while the flash welder eliminates hand labor. Various items of portable equipment contribute largely to the simplification of shop work and materials, and the organization and the material routing details which have lead to major economies are outlined.—*Iron Age,* Nov. 8, 1928.

Electrophysics, Electrochemistry and Batteries

What Is the Magnetic Permeability of Iron?—T. D. YENSEN.—The author, as the result of an extension investigation of the subject of the magnetic properties of iron, has concluded that iron is about as unfortunate a material to use as a magnetic standard as can well be found. This contention is supported by certain data presented in this discussion and the particular limitations involved pointed out. A special iron referred to may apparently be any one of the more recently announced alloys said to possess highly magnetic properties. So far as the utility of this iron is concerned, nothing much can be said at the present time because of its great susceptibility to other elements, principally carbon, oxygen, and perhaps nitrogen. Aside from the difficulty of its preparation in the first place, it is stated that it is not easy to obtain it in the form of thin sheets without ruining the magnetic properties beyond repair, largely because of oxidation and grain refinement.—*Journal of the Franklin Institute,* October, 1928.

Harmonic Production in Ferromagnetic Materials at Low Frequencies and Low Flux Densities.—EUGENE PETERSON.—The behavior of magnetic materials to complex waves of magnetizing force is ordinarily a highly involved process, so that a direct correlation between distortion and some of the easily measured constants of materials is a matter of some difficulty. It has been established experimentally, as a confirmation of theoretical speculations, that the third harmonic emf. generated by a sinusoidal wave of magnetizing force may serve as an index of the distortion with a complex wave of magnetizing force. This relation is valid for low flux densities and for frequencies at which the screening effect of eddy currents is not important. The paper is therefore devoted to an investigation of the third harmonic production in its dependence upon the properties of hysteresis loops. These loop constants in turn are shown to be deducible from alternating-current bridge measurements on a coil of known dimensions having a core of the magnetic material under investigation. The loop constants for a few materials are included in the text. An analogy exists between the treatments of hysteresis loop of three-element vacuum tube characteristics which enables us to compare simplifying relations introduced by Rayleigh and by H. J. van der Bijl in the two cases. The theoretical deductions are found to be in general agreement with experiment and are applied to a number of cases of practical interest.—*Bell System Technical Journal,* October, 1928.

Traction

Great Northern Railway Electrification.—EDWARD L. MORELAND and RALPH D. BOOTH.—The operating features of the transportation system which permitted the institution of electrified operation have been reviewed and the principle characteristics of the motor-generator type of locomotive now in service and to be used in future extensions have been pointed out. A description of the electric transmission and distribution systems along the railroad line, with particular emphasis on the relay protection designed to guard the system so far as practicable against interruption of power supply at the locomotives has been included, as has a description of the converter stations for transforming the 110,000-volt, 60-cycle, three-phase power to 25-cycle, single-phase power as applied to the tractive units.—*Journal of the American Institute of Electrical Engineers,* November, 1928.

Telegraphy, Telephony, Radio and Signals

Direct-Current Generators of Very High Voltage.—S. R. BERGMAN.—An unusual type of high voltage direct-current generators has been developed in ratings from 5 to 150 kw. and ranging in voltage from 7,500 to 15,000 volts. In appearance the machine resembles more an induction motor than a direct-current generator. The field consists of a slotted sheet steel structure and the winding of a plurality of coils assembled into a lap winding. These features are radical departures from the conventional type of direct-current machines with salient poles carrying concentrated field coils. The characteristics of this type of machine depend mainly upon the fact that the armature reaction is completely neutralized by the compensating winding and that there is no distortion of the field flux, as is the case with non-commutator machines. The efficiency is high and there is a remarkable freedom from voltage ripple. The machines described in this article were developed for service in radio transmission and the author practically acknowledges that at present he does not know of any commercial application for them outside of this field. Due to recent improvements in the alternating-current power transmission it does not seem likely that high-voltage direct current will be competitive with the highly developed alternating-current system — *General Electric Review,* November, 1928.

Miscellaneous

The Determination of Stress and Strain During Impact Indentation.—JUNZO OKUBO and MASATAKE HARA.—The investigation reported in this article consisted of experimental work undertaken to ascertain the phonomena relating to the impact of two bodies. The investigation was designed to take up the subject where previous research had ceased. The authors conclude that: The coefficient of restitution diminishes as the velocity just before the impact increases, and beyond a certain value of this velocity it diminishes linearly; the time of contact between impinging spheres and the specimen diminishes as the velocity of the impact increases; in the case of an impinging sphere the volume of indentation is proportional to the total loss of the kinetic energy up to that instant; the penetrating sphere is subjected to a resisting force which is proportional to the area of the circle on the surface of the specimen at the instant of identation; there are three phases of impact, namely, the time of indentation, that of reaction, and that of release, among which the time of reaction is the shortest, and the time of release is the longest; under certain conditions and with certain specimens the third phase just mentioned is completely lacking and the impinging body is subjected to a further accelleration beyond zero line of contact.—*Journal of the Franklin Institute,* October, 1928.

The Practical Application of the Fourier Integral.—GEORGE A. CAMPBELL.—The growing practical importance of transients and other non-periodic phenomena makes it desirable to simplify the application of the Fourier integral in particular problems of this kind and to extend the range of problems which can be solved in closed form by this method. The author states that unless the physicist or technician is in a position to evaluate the definite integrals which occur, by mechanical means, he is usually entirely dependent upon the results obtained by the professional mathematician. To facilitate the use of the known closed form evaluations of Fourier integrals, many of them have been compiled and tabulated in this discussion. They are presented, however, not as definite integrals but as paired functions, one function being the coefficient for the cissoidal oscillation and the other function the reciprocally related coefficient for the unit impulse. This arrangement simplifies the table and promises to be most convenient in practical applications, since it is the coefficients of which are used.—*Bell System Technical Journal,* October, 1928.

Book Reviews

Electric Lines and Sets

Their Theory and Electrical Behavior. By A. E. Kennelly. New York: McGraw-Hill Book Company, Inc. Second edition, revised and enlarged. 420 pages, illustrated. Price $5.

This book was formerly published with the title "Artificial Electric Lines" in 1917, and the development of the art since that time rightly warrants a change in title and a revision. Dr. Kennelly in this work develops and expands those principles and methods that have been welcomed by engineers. His original and effective treatment of complicated electrical circuits makes possible a technical solution to many network and line problems encountered by engineers. The development of electrical systems has been so rapid that only by the use of very expert methods is it possible to work out mathematical solutions to engineering problems.

The electrical network is the fundamental circuit set-up for the application of the general theory and individual line problems are subordinate. Any electric conducting network connecting selected pairs of terminals subtends a complex angle, the numerical value of which, at any given frequency, indicates directly the nature and extent of the connection. This theory is comprehensive and admits of the use of some original and beautiful mathematical solutions to network problems. This book is a splendid contribution to the literature and will be used by transmission engineers to attach the practical problems encountered in the field.

Wirkungsweise Elektrischer Maschinen

By Dr. Milan Vidmar. Berlin: Julius Springer. 223 pages, 203 diagrams.

The conventional procedure of starting with the direct-current generator in teaching the operating principles of electrical machinery, of which a knowledge is necessary to every electrical engineer irrespective of his special field of work, is probably unavoidable if begun at the same time with instruction in electrical circuits. But if, as seems to be common practice abroad, the subject is preceded by a course including at least the elements of alternating-current theory, including vectors, that limitation vanishes. In the present book, the author develops the idea that the transformer is physically the simplest machine, and that all other forms may be derived from it by successive modifications. The plan necessarily throws the direct-current generator and motor far toward the end of the book—into the final third, in fact—followed only by the synchronous converter and a.c. commutator motors. In its logical and smooth development from the simple to the complex, tied together by repeated references to the transformer as the basic type, the innovation is really far less radical than one accustomed to the traditional sequence might imagine. The reading is easy, the thought being clearly and interestingly expressed without undue condensation, real virtues in an elementary text. Mathematical form is avoided where feasible and details of construction are omitted, the aim being primarily to give a physical concept of what happens when the machine is working.

Electric Circuits Theory and Applications

Vol. I, Short-Circuit Calculations and Steady State Theory. By O. G. C. Dahl. New York: McGraw-Hill Book Company, Inc. 384 pages, illustrated. Price, $5.

Books on stability are to be expected after the many discussions of this topic in recent years. Power systems have grown and have become a network of stations and lines that present many technical problems. The calculation of short-circuit currents at any point with a proper evaluation of all factors that effect short-circuit conditions is a major topic treated by Mr. Dahl in this book. Another problem deals with the power limits or stability of any part of an electrical system when in trouble, holding many units in synchronism when connected by many lines serving many loads and when trouble occurs is difficult at best, and the predetermination of stability limits is even more difficult.

The book is written from the engineer's point of view and gives the methods and tools to apply to power system circuit problems. It is intended for an advanced text in the colleges and is written from the teacher's perspective. Such topics as short circuits, equivalent circuits and transformer impedance, unbalanced circuits, transmission lines under different conditions, harmonics, general circuit constants and steady slate transmission line problems give an idea of the scope of the work. The theory and application of the general subject are not yet complete, but this book gives a good treatment of the general problem.

Deutschlands Grosskraftversorgung

By Dr. Gerhard Dehne. Berlin: Julius Springer. 142 pages, 70 illustrations.

A study of the electrical progress of an important industrial nation, with a population half as great as that of the United States, though relatively much smaller in area, is of interest beyond her borders. The present work merits examination by the engineer, economist or student of international relationships who desires a comprehensive picture of Germany's present status in the use of electrical energy and a foreshadowing of future trends. These indicate a closely integrated nation-wide development of the highest attainable efficiency in the use of her limited energy resources. The possibility of connections with neighboring countries is not overlooked. Germany has 27 systems each with an annual output, in 1926, of 100,000,000 kw.-hr. or more. [The United States had 126 such systems.] These are the ones considered by the author as "major systems."

In an introductory chapter the progress from small isolated plants is rapidly traced through the achievement of 100-mile, 25,000-volt transmission in 1891 to the huge plants and systems of today. The matter of governmental operation or participation is touched upon. The various regional systems using coal, lignite and water power are then taken up individually. Numerous maps and statistical charts constitute the illustrations.

Book Notes

THE ELECTRIC WORD. By Paul Schubert. New York: MacMillan Company. 311 pages, no illustrations.

A semi-popular work based on scientific facts, relating to the rise of radio in the maritime, military and popular fields. The commercial and social significance of this development as well as some of the outstanding problems which have had to be solved or still remain are presented.

DIE GLEICHSTROM QUERFELD MASCHINE. By E. Rosenberg. Berlin: Julius Springer, 1928. 97 pages with 102 illustrations.

The direct-current cross-field generator of the Rosenberg type has been used for more than twenty years as a railway car lighting dynamo in many countries. Since the introduction of electric arc welding the peculiar characteristics of this generator opened a new field of wide application. The book covers the principle, the theory and practical use of this generator for both train lighting and welding. In a clear way the gradual development and the latest achievements of these machines are described. German, French, Russian, English and American variations of the generator are shown. Short mention is made of the dynamo for wind power plants and for searchlight service.

CONSTRUCTION OF ALIGNMENT CHARTS. By George W. Swett. New York: John Wiley & Sons, Inc. 89 pages, illustrated. Price, $2.

There are comparatively few texts devoted to the principles underlying the construction of alignment charts. A designer or engineer is seldom able to procure a chart which is entirely satisfactory for the particular problem at hand, and therefore the ability to construct a chart for special conditions may enable him to save time and labor and eliminate costly errors. This work is offered to those who wish to gain a workable knowledge of the subject, but who are not interested in a highly specialized mathematical treatise.

Books Received

Engineering English. By John Hubert Scott. New York: John Wiley & Sons, Inc. 313 pages. Price, $2.75.

The Principles of Electric Power Transmission by Alternating Currents. By H. Waddicor. New York: John Wiley & Sons, Inc. 397 pages, illustrated, Price, $6.

Electrical Substations. By H. Brazil. New York: Longmans, Green & Company. 209 pages, illustrated. Price, $5.

News of the Industry

Engineering Feasibility of Boulder Dam

Colorado River Board Upholds It, but Suggests Black Canyon as a Better Site—Revenue from Power Would Not Recoup Government—Cost Up Many Millions

CONFIDENCE in the engineering practicability of the proposed government dam in Boulder Canyon on the Colorado River; preference, however, for the Black Canyon site, 20 miles down the bed of the stream but still on the Arizona-Nevada border line, and estimates that, including the contemplated All-American and Coachella Valley canals, the completed development would cost $176,000,000, or $51,000,000 in excess of previously accepted estimates, and that this sum could not be recouped by the government through the sale of electrical energy—these are the outstanding points made in the report of the Colorado River Board, appointed after Congress adjourned last May, to the Secretary of the Interior and transmitted by the latter to Congress on Monday. Major-General William L. Sibert is chairman of this board, and its members—prominent engineers or geologists—are Charles P. Berkey, Daniel W. Mead, Warren J. Mead and Robert Ridgway. Following are extracts from the report:

Comparison of the Two Sites.—In general, geologic conditions at Black Canyon are superior to those at Boulder Canyon. The Black Canyon site is more accessible, the canyon is narrower, the gorge is shallower below water level, the walls are steeper, and a dam of the same height here would cost less and would have a somewhat greater reservoir capacity. The rock formation is less jointed, stands up in sheer cliffs better, exhibits fewer open fractures, is better healed where formerly broken, and is less pervious in mass than is the rock of the other site. The Black Canyon rock is not so hard to drill as that of Boulder Canyon. . . . The district is recognized as having comparative freedom from present-day earth movements, and the conclusion is that danger from local earthquakes of enough violence to threaten a property constructed dam is negligible.

The board is of the opinion that it is feasible from an engineering standpoint to build a dam across the Colorado River at Black Canyon that will safely impound water to an elevation of 550 ft. above low water. The cost, however, will be greater than that contemplated in the project authorized in H. R. 5773. . . .

Estimates of Cost.—The board in its review of the estimates for the proposed structures has reached the conclusion that such estimates should be modified so as to provide as follows:

Dam and reservoir (26,000,000 acre-feet capacity)	$70,600,000
1,000,000 hp. development	38,200,000
The All-American Canal	38,500,000
Interest during construction on above	17,700,000
Total	$165,000,000

In this revision stresses in the dam have been limited to a maximum of 30 tons per square foot and a diversion capacity of 200,000 second-feet is provided. Should the canal to Coachella Valley be considered a part of the main canal, the above estimates would be increased by the sum of $11,000,000. This would make the total estimated cost for all items $176,000,000. These estimates are based on a construction period of seven years.

Adequacy of Proposed Structures.—A dam of 550 ft. above low water across the Colorado River at Black Canyon, impounding 26,000,000 acre-feet of water, will be adequate, in the opinion of the board, so to regulate the flow of the lower Colorado as to control ordinary floods, to improve the present navigation possibilities, and to store and deliver the available water for reclamation of public lands and for other beneficial uses within the United States. . . .

Power.—Based on the foregoing estimates of the variation of flow of the Colorado River, it is believed that *under present conditions* of irrigation a continuous output of 550,000 hp., or 1,000,000 hp. on a 55 per cent load factor, could be maintained even during the years of normal low flow. A fairly rapid irrigation development is, however, to be expected in the entire Colorado River basin, provided the "seven-states compact" is consummated, and, if the Boulder Canyon project is undertaken, preparations for such development may be expected in both the upper and lower basins during the construction of such project. . . .

Economic Feasibility.—The time available for the investigation in preparation of this report has not been sufficient to permit the board to go into all phases of this subject in the detail necessary to fix its findings with the degree of exactness which might otherwise be practicable. The board believes, however, that it has been able to review the available data with sufficient thoroughness to warrant the conclusions expressed in this report.

In considering the economics of this project the board recognizes the importance, among others, of the following factors:

1. While much land has already been brought under irrigation on the Colorado River delta in Mexico, it is evident that such development has been retarded by the lack of water available from the river during low-water periods. The storage of flood water in the Black Canyon reservoir and its release during low-water seasons will make more water available in Mexico and will invite immediate expansion in irrigated acreage in that country. With the limited water supply available from the Colorado River, every acre permanently irrigated in Mexico will mean that an acre in the United States cannot be irrigated. Such a limitation on lands would result in a corresponding limitation on possible income. It is the opinion of the board that it is of much economic importance in this project that an agreement limiting the amount of water assignable to Mexico should be made prior to the completion of the Boulder Canyon project.

2. The board believes that the growing demand for power in southern California, when considered on a conservative basis, will be sufficient to absorb the probable power output of the proposed hydro-electric plant.

3. As a sound basis for estimating the probable power output of a stream, it is necessary to know the flow of the stream for a long term of years covering periods of low and high flow of sufficient duration to furnish the low, average and high flows for which the plant must be designed. Any less complete data throw doubt on the estimates, which becomes serious in proportion to the uncertainties in the data and the magnitude of the investment. When this project was first proposed the cost of steam power in southern California was such as to leave a reasonable margin of profit above the probable cost of hydro-electric power generated at the proposed power plant. With the reduction in costs of power generated by steam, this margin has been greatly reduced. The operation, maintenance, interest and sinking fund for the Boulder Canyon project must be paid from the sale of power and of storage services, which latter has been estimated at $1,500,000 per annum by the Secretary of the Interior. Based on the foregoing and the shortage of power which will occur at flow, the board is of the opinion that if the Boulder Canyon project is completed and put in operation, carrying as it does the costs of flood protection works and the All-American Canal, it will be impossible to meet operation, maintenance, interest and a sufficient sinking fund to retire the cost of the project within a 50-year period.

4. It is obvious that the power which can be generated from Boulder Dam is a valuable resource. If the income from storage can be reasonably increased and the capital investment reduced by the cost of the All-American Canal together with a reduction for all or a part of the cost properly chargeable to flood protection, it would be possible to amortize the remaining cost with the income from power.

Senators Hayden and Johnson Discuss Boulder Dam

Called before the Senate as unfinished business of the preceding session by one of its sponsors, Senator Hiram Johnson of California, the Boulder Canyon Dam bill caused an immediate debate on Wednesday. A parliamentary advantage was gained when the House bill was substituted for the Senate measure. Senator Hayden of Arizona again put forth the objections of that state. He offered suggestions for a compromise.

The Arizona Senator called attention to the portion of the President's message opposing any provision for putting the government in the power business on the Colorado. He also reminded Senator Johnson of the increased cost estimated for the project in the report of the engineers' commission. Senator Johnson replied that he had just re-

ceived evidence substantiating the original estimate of the cost of the dam, $28,000,000, made in the Weymouth report. Senator Johnson also said that he construed the President's position as opposing the government's engaging in the retailing of power rather than opposing its construction and operation of a hydro-electric plant.

Senator Phipps of Colorado, who opposed the Swing-Johnson bill as it stood, has introduced amendments to that measure to increase the cost to $165,000,000 and to eliminate the All-American Canal if that feature is found impracticable from an economic standpoint. Another amendment offered by Mr. Phipps provides that the estimate of $25,000,000 for flood protection shall be charged to flood control and shall not be repaid to the government except out of surplus and revenues.

Senator Walsh Has Two Bills Aimed at Propaganda

A bill aimed at propaganda in the schools by "any person, firm or corporation engaged in interstate commerce" has been introduced in the United States Senate by Senator Walsh of Montana. It makes it illegal to induce any schoolteacher to "teach or expound any doctrine, dogma or theory with intent to influence opinion in favor of any particular governmental action or public policy advocated by or beneficial to such person, firm or corporation, or the business in which he or it may be engaged," and imposes a fine of $1,000 or imprisonment for not more than six months, or both fine and imprisonment, for violation.

Another bill fathered by Senator Walsh would bar from the second-class mails any publication accepting reading matter for pay, unless it is obviously advertising.

A.S.M.E. Convention Meets in New York

With its usual large attendance plus the attraction of the annual Power Show, the winter convention of the American Society of Mechanical Engineers, held in New York this week from Monday to Friday inclusive, scored an entire success. As is always the case, some of the technical proceedings were of direct interest to electrical engineers and central-station executives as well as to mechanical engineers. These papers and discussions dealt with illumination, coal pulverization, motor applications and other topics. They will be reported next week.

At the annual dinner on Wednesday evening speeches were made by the retiring president, Alex Dow, president of the Detroit Edison Company; the president-elect, Elmer A. Sperry, and Dr. Edward E. Free of New York. Dr. Free, differentiating intelligence from information, rated the former as shown by men engaged in various occupations, placing engineers above business men but below mechanics.

To Adjust State and National Regulation

Federal Power Commission's Report Asks Legislation Providing for Control of Interstate Traffic in Electrical Energy —Sees No Decline for Water Power

GOING contrary to the view accepted by some authorities on power generation, the Federal Power Commission in its annual report to Congress, just made, denies any indication that production of hydro-electric energy is losing ground in comparison with production from fuel sources. It asserts that water power continues to furnish about one-third of the total demand for electrical energy and says that the development of the nation's water-power resources has continued at a gratifying rate during the past fiscal year, despite the restrictions that still apply to the development of projects on the St. Lawrence, Colorado and Tennessee Rivers.

The most significant portion of the commission's report is its discussion of relations between the federal government and the states in the matter of regulation of the transmission of electricity across state boundaries. The commission, without recommending specific legislation, suggests that the problem of jurisdiction might be dealt with by delegating authority to the states to act individually in certain cases involving the sale of power across state lines, and original jurisdiction to act jointly in certain other cases, and "by conferring on some federal agency some jurisdiction to review on appeal the findings of the state agencies where the states acted jointly."

"A procedure of this character," the commission says, "would leave the final authority in cases involving more than one state where it properly belongs, in the hands of the federal government; would give to individual states the right to settle their own differences, and would avoid the necessity of overloading federal agencies with details or with matters that the states had better decide for themselves. The adoption of any such procedure would, of course, require new federal legislation, scarcely to be justified unless it is to be applied to interstate energy transfers in general, for the number of cases likely to arise under the federal water-power act alone does not appear sufficient to warrant changing the procedure already prescribed by that act."

The commission summarizes the interstate traffic problems involved in the Rhode Island-Massachusetts and the Conowingo cases and says of its own jusisdiction:

> Under the limitations of Section 19 [of the water-power act] no regulation that may be so exercised will overlap or encroach upon the jurisdiction of the state, for if and when the state assumes jurisdiction over any matter the exercise of control by the Federal Power Commission *ipso facto* terminates.
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> It is of interest to note in this connection that no state commissions for the regulation of the operations of electric power corporations have been provided in Delaware, Florida, Kentucky, Minnesota, Mississippi, South Dakota or Texas; that only a limited jurisdiction over such corporations has been given to the state commissions of Arkansas, Iowa, Louisiana, Nebraska and New Mexico, and that only one-half of the states have given their commissions control over the security issues of such corporations.
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> A review of these provisions of the federal water-power act indicates that Congress intended to provide for public regulation of all licensees, and to place the responsibility for such regulation upon the states wherever they had the authority or machinery to exercise it. The cases of interstate energy transfers to which the federal water-power act applies are, of course, only a very small part of all those which exist. Such transfers are, however, becoming increasingly more numerous and their importance is not to be determined merely by percentage relations for the United States as a whole.

Referring to the duty of the Federal Power Commission to check the accounting of applicants for licenses, the report says that it would be a distinct aid to the state regulatory bodies were the commission better equipped to perform this duty. It makes its familiar plea for an enlarged staff.

An increase in the amount of installed generating capacity in hydro-electric plants in the United States from about 7,000,000 hp. in July, 1920, when the commission was first organized, to about 12,000,000 hp. in July, 1928, is reported. In addition licenses have been issued for about 4,000,000 hp. that has not yet been produced, and the commission "has been restrained from taking action upon a large number of applications involving from 12,000,000 hp. to 14,000,000 hp., most of which pertained to the best rivers of the country."

The budget just submitted to Congress carries $179,500 for the Federal Power Commission. This is an increase of $52,800 over the present appropriation, when the 1928 salary increase is taken into account. The increase is intended largely for additional personnel. It is proposed to engage directly a law officer rather than call upon the departments for the detail of a man to act as the commission's chief counsel. The salary is $6,500. It also is planned to pay $5,600 for an attorney to handle valuation matters. An additional engineer, to receive $4,600, is requested.

Power Commission Hearing of Cumberland Falls Project

Advocates and opponents of the application for permission to erect a hydro-electric plant at Cumberland Falls in Kentucky were heard publicly by the Federal Power Commission on Wednesday. Contention raged around the extent, if any, to which development of this site would injure the natural beauty of the falls and their surroundings. A résumé of arguments pro and con will be printed next week.

M. J. Insull in Defense of Consolidations

President of Middle West Utilities Company Sees Holding Companies as Investment Bodies—Champions Small-Town Electrification

CONTINUED consolidation of electric power systems, not necessarily accompanied by extension of any single group's control, was forecast by Martin J. Insull, president Middle West Utilities Company, addressing the Advertising Club of New York on Nov. 30.

"For purposes of economical operation," Mr. Insull said, "it is quite possible that the next development of the electrical industry should be the consolidation of some of the smaller existing operating companies in a state into one large operating company irrespective of where the ownership and control of the present operating companies might rest. This might result in several holding companies having an interest in the larger company in proportion to their interest in the smaller constituent companies, although none may have actual control. As long as the industry is properly regulated by state commissions, such a procedure could only result in public benefit, in terms of rates as well as service. This has been the experience of the past on a smaller scale, since most of the existing operating companies are made up by the merger of smaller operating units. This would also tend to bring the so-called holding companies nearer to what they really are—investment companies. Already they have not hesitated to make substantial investments without assuming complete control of operating companies—simply to expedite this consolidation of facilities which is so necessary if the public is to have maximum service at the lowest consistent rates."

Already, Mr. Insull said, the so-called holding companies have to their credit the electrification of the small towns, villages and hamlets, and now increasingly of the farms, on a standard of service equal to that of metropolitan areas. "This electrification of the small town is of tremendous importance to the nation. Electric power and improved transportation are fitting the small towns for industrial development, enabling industry to decentralize and operate at lower costs and under more pleasant living conditions for the workers."

Mr. Insull dwelt also on the importance of public understanding of the utilities and on the strides made in this direction in the last ten years.

President on Boulder Dam and Muscle Shoals

That the President regards the report of the Colorado River board on the Boulder Canyon project as sufficiently favorable to warrant enactment of legislation at this session of Congress is indicated in his message. The full text of his comment on the Colorado River situation follows:

For several years the Congress has considered the erection of a dam on the Colorado River for flood control, irrigation and domestic water purposes, all of which may properly be considered as government functions. There would be an incidental creation of water power which could be used for generating electricity. As private enterprises can very well fill this field, there is no need for the government to go into it. It is unfortunate that the states interested in this water have been unable to agree among themselves. Nevertheless, any legislation should give every possible safeguard to the present and prospective rights of each of them.

The Congress will have before it the detailed report of a special board appointed to consider the engineering and economic feasibility of this project. From the short summary which I have seen of it, I judge they consider the engineering problems can be met at somewhat increased cost over previous estimates. They prefer the Black Canyon site. On the economic features they are not so clear and appear to base their conclusions on many conditions which cannot be established with certainty. So far as I can judge, however, from the summary, their conclusions appear sufficiently favorable, so that I feel warranted in recommending a measure which will protect the rights of the states, discharge the necessary government functions and leave the electrical field to private enterprise.

In his message to Congress the President reiterated his opposition to the entry of the government into the retail field of power distribution and sale of fertilizers. The full text of his reference to Muscle Shoals in his message to Congress follows:

The development of other methods of producing nitrates will probably render this plant less important for that purpose than formerly. But we have it, and I am told it still provides a practical method of making nitrates for national defense and farm fertilizers. By dividing the property into its two component parts of power and nitrate plants it would be possible to dispose of the power, reserving the right to any concern that wished to make nitrates to use any power that might be needed for that purpose. Such a disposition of the power plant can be made that will return in rental about $2,000,000 per year. If the Congress would grant the Secretary of War authority to lease the nitrate plant on such terms as would insure the largest production of nitrates, the entire property could begin to function. Such a division, I am aware, has never seemed to appeal to the Congress. I should also gladly approve a bill granting authority to lease the entire property for the production of nitrates.

I wish to avoid building another dam at public expense. Future operators should provide for that themselves. But if they were to be required to repay the cost of such dam, with the prevailing commercial rates for interest, this difficulty will be considerably lessened. Nor do I think this property should be made a vehicle for putting the United States government indiscriminately into the private and retail field of power distribution and nitrate sales.

Federal Trade Commission Goes Into Court

Files Petition to Compel the Electric Bond & Share Company to Answer Its Questions, Declaring Them Pertinent to the Utility Investigation

APPLICATION for an order compelling the Electric Bond & Share Company to produce certain records for examination by the Federal Trade Commission and to answer certain questions concerning the company's business was filed in the United States District Court for the Southern District of New York on Dec. 1 by commission counsel.

The application describes the position taken by the company's officers in refusing to obey subpœnas for the records in question and to give testimony on the witness stand. The demands made by the commission, it is insisted, are in accordance with the Senate resolution directing the investigation into activities of public utilities.

The commission at the same time sent to the Senate its eighth interim report on the public utilities investigation, covering details of the Electric Bond & Share Company case. Officials of the company appeared before the commission in two public hearings and on both occasions declined to comply with the commission's request to furnish the desired data and refused to answer various questions put to them while on the stand, according to the report. Representatives of the commission, it is pointed out to the Senate, are still at work in the offices of the Electric Bond & Share Company, with the consent of that company, examining various books and papers.

"The company has permitted and continues to permit," the commission says, "an examination of all books and papers except the operating expense ledger and the supporting vouchers and documents. Although certain other papers have been requested and have not yet been furnished, they have not yet been refused."

In the petition the commission states at much length its position on the refusal to give testimony, in order to show its right to demand the information sought and the pertinency of this information to the investigation. Exhibits giving the names of the holding companies in whose organization the Electric Bond & Share Company is said to have participated, with the names of the subsidiary companies thus controlled, are included.

Engineering Abbreviations Ready for Criticism

A "tentative American standard" covering abbreviations for scientific and engineering terms has been completed by a sub-committee of the sectional committee on the standardization of scientific and engineering symbols and abbreviations appointed by the American Engineering Standards Committee (now the American Standards Association). This tentative standard is now being submitted to the sectional committee for approval, and copies have been distributed. The sectional committee consists of 39 men, representing 37 national organizations composed of manufacturers, consumers and general interests. It was organized in January, 1926, with the American Society for the Advancement of Science, the American Institute of Electrical Engineers, the American Society of Civil Engineers, the Society for the Promotion of Engineering Education and the American Society of Mechanical Engineers as joint sponsors under the procedure of the American Standards Association. Suggestions and proposed changes may be mailed to the committee's secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

Alabama Power Company's New Rate Plan Opposed

That the revision in electric rates proposed by the Alabama Power Company would involve an increase for the class of consumers who could least afford to pay more was the gist of the argument of mayors and other representatives of various towns who appeared before the Public Service Commission of Alabama last week to oppose the new schedule.

"It is not an injustice to require the larger homes to pay a higher minimum charge," E. W. Ashmead, representing the company, said. "This method is easily understood by the customer and there is less chance of disagreement. Less than half of the customers will be asked to pay more. The smaller users are now being served at no profit or at less than cost. The new rate was designed to distribute the cost of service among residential customers as nearly as can be done fairly in proportion to their individual requirements."

Mr. Ashmead also testified that the effect of the proposed rate in the towns analyzed by his staff would indicate that 29.3 per cent of the residential lighting customers would have their bills increased by an average of more than 25 cents a month, 31.9 would have their bills decreased by more than 25 cents a month and 38.8 would not be materially affected. The new schedule would reduce the company's annual revenue by $300,000 on the basis of present use.

After city officials of Tuscaloosa, Mobile, Anniston, Florence and Northport had been heard the hearing was adjourned until Dec. 15.

The city authorities of Mobile are seeking from the Public Service Commission restoration of contract rates that existed in 1906 between the city and the old Mobile Electric Company. By a Supreme Court decision of about ten years ago this contract was declared valid until 1940 unless the franchise of the utility expired sooner. On the authority of subsequent legislation, passed in 1920, extending the commission's powers, the latter body altered the rate provisions of the contract. The city now maintains that the commission was without power to do so and is trying to force the Alabama Power Company, present owner of the Mobile system, to go back to the rates of 22 years ago.

Submetering Question Before New York Commission

The much-disputed issue over the right of owners of large buildings to install master meters and themselves retail electricity to their tenants, the owners getting wholesale rates and thereby profiting by the difference between these and the legal rates for small consumers, came before the New York Public Service Commission on Tuesday of this week when seven cases involving the Brooklyn Edison Company, the New York & Queens Electric Light & Power Company and the Bronx Gas & Electric Company were heard. The key case concerned an attempt of the Brooklyn Edison Company, which is opposed to submetering, to discontinue service to the Survel Realty Company unless the latter ceased to redistribute the energy from its master meter to apartment-house tenants. The realty company had obtained a court order restraining the Brooklyn Edison Company from removing its meter pending a decision of the Public Service Commission.

The hearing was adjourned until Friday morning. Should the Brooklyn Edison Company win the case, an appeal to the courts may be taken. A final victory would probably bring the discontinuance of submetering in Greater New York and perhaps in other large cities where the practice prevails.

Fostoria Substation to Unite Philo-South Bend Lines

Coming construction of a large electric substation at Fostoria, Ohio, by the Ohio Power Company is reported. The new substation, covering approximately fifteen acres when completed, will be the junction point of a new 132-kv. transmission line from the company's Philo station, Muskingum County, with a line of the same voltage running to South Bend, Ind. From the Fostoria station electrical energy will be distributed to Fremont, Tiffin, Kenton and other cities and villages. The work of obtaining the right-of-way for the line is said to be virtually completed. The line from Philo to Fostoria, a distance of 125 miles, will pass through six counties. From Fostoria to South Bend the distance is still longer.

Purchases and Mergers

Reports that the Holyoke (Mass.) Power & Electric Company, subsidiary of the Holyoke Water Power Company, had been sold to the Western Massachusetts Companies are denied by the heads of both.

Agreement of merger between the Delaware Public Service Company and the Delaware Electric Power Company, under the name of the latter, was approved by the stockholders of the respective companies this week. The Delaware Public Service Company owned the stock of the American Power Company and the Newcastle County Electric Company, which operated transmission lines extending from Wilmington to the Maryland line and to Townsend, Del. The Wilmington Light & Power Company, Wilmington City Electric Company, American Power Company and Newcastle County Electric Company were also merged under the name of the Delaware Power & Light Company.

Sale of the Archbold Electric Service Company to the Toledo Edison Company for $68,140, previously reported, has been approved by the Ohio Public Utilities Commission. The Archbold property will be maintained as a distributing unit.

Sale of the North Lewisburg Light & Power Company to the Ohio Edison Company has been authorized by the Ohio Public Utilities Commission.

The petition of the Interstate Public Service Company of Indianapolis for permission to buy the property of the Cynthiana Light & Power Company for $19,090 has been granted by the Indiana Public Service Commission.

Permission from the Missouri Public Service Commission to the Union Electric Light & Power Company of St. Louis to acquire from the Nortn American Company the stock of the East St. Louis Light & Power Company, the Union Electric Light & Power Company of Illinois, operating the Cahokia plant, three railway companies and a gas company has been granted. (ELECTRICAL WORLD, Nov. 10, page 710.) The total consideration in cash and stock is put at more than $18,000,000.

The Old Dominion Power Company of Louisville, Ky., recently purchased the electric plant of the Stuart (Va.) Light & Power Company. Power lines will be built to nearby communities.

The Georgia Power Company has purchased the electric distribution system in Manchester, Ga., from the National Utilities Company of Georgia and will immediately take over its operation, building a transmission line from Woodbury to Manchester.

A committee of Woodward (Okla.) business men which opposed the sale of the municipal light and power plant at Woodward to the Western Light & Power Corporation of Salina, Kan., is endeavoring to upset a court decision holding that the city officials had power to convey the plant despite failure to obtain a 60 per cent majority at the polls. The dispute hinges on whether or not the charter of the city was legally adopted.

The Public Service Company of Colorado has asked the Public Utilities Commission for permission to take over and operate the plant and transmission lines of the Summit County Power Company, having bought the property, which has been closely associated with the purchaser, for a sum in excess of $400,000.

Wisconsin's Legislators Hear Utility Defense

W. J. Hagenah, G. C. Neff and Ralph Moody Dispute Claims Put Forth by Advocates of Municipal Ownership and Clear Up Misunderstandings

THREE representatives of the privately owned utilities in Wisconsin presented arguments and data before the interim power committee of the Legislature on Nov. 26 and 27 in reply to the League of Wisconsin Municipalities' arguments for municipal ownership of electric light plants and distributing systems. W. J. Hagenah, vice-president Byllesby Engineering & Management Corporation; G. C. Neff, vice-president Wisconsin Power & Light Company, Madison, and Ralph Moody, research engineer for the Milwaukee Electric Railway & Light Company, all declared that government ownership was unfair to the taxpayers, the utilities and the investors in the utilities and that it would be uneconomical.

Mr. Hagenah declared untrue the statement made by Mayor Daniel Hoan of Milwaukee that utilities are guaranteed a return of 8 per cent on the reproduction cost of their property. He stated that there is no city, county, state or federal law or regulatory commission or court decision giving utilities directly or indirectly an 8 per cent guaranteed return. They are permitted to earn a specified return if they can. Most companies are not earning 8 per cent. If utilities earn more than 8 per cent, rates are reduced by the commission, and if they earn less the loss falls on stockholders. Mr. Hagenah contended that utilities do not want a valuation based on replacement value and contended that valuations are not now so made. He said that with shifting costs there is now only about 12 per cent difference between valuation based on actual investment and valuation based on replacement cost and contended that this spread is gradually diminishing, with the prospect that within a few years a valuation based on actual investment will be higher than the replacement cost. The speaker defended holding companies and praised customer ownership. He dissented from charges of overcapitalization, saying that the Byllesby interests have a property investment of $58,000,000 in excess of the par value of outstanding securities.

Mr. Neff declared customers of privately owned electric companies in Wisconsin would have had to pay at least $6,000,000 more than they actually paid for their electricity in one year if they had been billed at the average rates charged customers of municipally owned plants. His assertion, he stated, was based on the United States census report for 1922, which showed an average rate of 3.40 cents per unit whereas municipal systems charged 4.74 cents. He brought the comparison to date with similar results and said that in Wisconsin only fourteen municipal plants generate sufficient energy to serve all the needs of their customers, that nine generate a part and purchase a part, and that 63 buy all their energy from private plants.

Mr. Moody submitted compilations taken from the United States Census Bureau figures to show that competition by municipally owned electric systems increases rates, because duplicate investments are necessary. Comparing rates in the largest cities owning generating plants, such as Los Angeles, Cleveland, Seattle and Tacoma, with rates in cities served by private companies in the same geographical location and taking into account the method of generation, Mr. Moody said that records show municipal rates to be higher than private rates. "The average revenue per kilowatt-hour of the Los Angeles system is 2.69 cents," he asserted; "for the private companies in the same state it is 1.59 cents. Seattle's and Tacoma's average is 1.65 cents and the private companies' 1.64 cents. The Cleveland municipal rate is 2.33 cents and the private rate 2.08 cents."

Indiana Commissioner Has a New Rate-Making Plan

Frank Singleton, chairman of the Indiana Public Service Commission, will urge the passage of a law by the General Assembly, which convenes in Indianapolis in January, to make the tax valuations of utility properties recognized as prima-facie evidence of between 75 and 80 per cent of actual value for rate-making purposes. It has been the practice of utilities in Indiana to stress before the commission the importance of replacement new as the only evidence of value in making rates.

In explaining his bill Mr. Singleton said: "I have heard it advocated that a law be passed to make tax valuation the basis of rates. I do not believe that such a law would be upheld by the courts, even if it could be passed. My proposal to make tax valuation represent at least 75 or 80 per cent would be more likely both of passage in the Legislature and court approval. Fair value should be fair to the utility as a basis of return and as fair to the utility's patrons as a basis upon which they must pay the rates prescribed."

Water Power and State Commission Maine Topics

Clarence C. Stetson, chairman of the Maine Development Commission, says that that commission will undertake a "fact-finding survey" of the power resources of the state with the approval of the Governor and Council. A special survey committee will be authorized to engage non-partisan engineers to collect and analyze available data. The investigation will cover demand in Maine for private and secondary power, also the present surplus of primary and secondary power and the surplus of power after full economic developments, both primary and secondary, shall have been made. The question of prospective power demand in Maine will have careful consideration. This report will be ready for the Legislature not later than Feb. 15.

Proposed changes in the law governing the Maine Public Utilities Commission are likely to come before the Legislature at its next session. One will be for the election of its members instead of their appointment by the Governor. Another will be to set up a "people's advocate" to take charge of complaints brought against the commission. The Maine commission already has the function of passing upon all utility bond and stock issues as well as fixing rates.

Large New Power Station for Eastern New Jersey

The Utilities Power & Light Corporation of Chicago announces that it will immediately build a steam-electric generating station at Sayreville, N. J., to be owned and operated by its subsidiary, the Eastern New Jersey Power Company. The plant will cost $6,000,000 and will have an initial capacity of 60,000 kw., derived from two 30,000-kw. turbo-generators. This capacity will be increased to 180,000 kw. in steps of 30,000 kw. as the demands for power require its expansion. There will be a coal storage capacity of 60,000 tons. The site adjoins the main channel of the Raritan River, which here has a depth of 15 ft. at low water, permitting coal to be delivered either by water or rail.

Rate Reductions for New Jersey Public Service

The Public Service Electric & Gas Company has filed with the New Jersey Board of Public Utility Commissioners new schedules of electric rates, effective Jan. 1, 1929, which it estimates will bring a saving to its customers of approximately $1,250,000 a year.

A "residence rate" is provided applying to energy used in residences whether for light or power purposes or both. Under it all energy consumed in residences of ten rooms or less in excess of 50 kw.-hr., or $4.20 worth a month, is charged for at the rate of 5 cents per kilowatt-hour, while in residences of more than ten rooms an additional consumption of 5 kw.-hr. a month per room must be reached before the 5-cent rate becomes effective. Under the present schedule the 5-cent rate is applied only after 1,500 kw.-hr., or $98.20 worth of electricity, has been consumed. Under the "general lighting rate" of the schedule, electricity is sold to commercial and industrial users for either lighting or power purposes. A reduction in the number of kilowatt-hours in all steps after the first two, which cover the first 50 kw.-hr. of consumption, is made. In addition to these reductions, the rate for wholesale power, affecting cost to users of electricity for industrial power purposes, is lowered for long-hour use in large quantities.

Briefer News

HUMBOLDT (NEB.) PLANT TO BE SHUT DOWN. — Early discontinuance, except for standby service, of the Iowa-Nebraska Light & Power Company's generating plant at Humboldt, Neb., is looked for as a result of the speedy completion of that company's transmission lines in southeastern Nebraska and northeastern Kansas, by which an extensive interconnected system will be provided. The company's main plant is at Lincoln, Neb.

MILWAUKEE'S NEW GENERATING UNIT READY FOR SERVICE.—The new 60,000-kw. turbo-generator of the Milwaukee Electric Railway & Light Company which has been in process of manufacture and erection since early in the year is ready for service at the Lakeside power plant. It ranks as the largest electrical unit in Wisconsin and cost in the neighborhood of $1,400,000. Installation of this unit brings the total rating of Lakeside to 191,000 kw.

ATTACK TIPPECANOE HYDRO PLANTS. —Suit to enjoin the Indiana Hydro-Electric Company from interfering with the natural flow of water in the Tippecanoe River has been filed in the Superior Court at Lafayette by fourteen property owners along the stream. According to the complaint the defendant company's dams in the Tippecanoe River at Norway and Oakdale interfere with the flow of water. A controversy between summer home owners along the river and the owner of the dams has been raging for some years.

POTOMAC ELECTRIC POWER'S 1929 RATE CUT TO REACH $625,000.—The amount which the Potomac Electric Power Company will cut off its electric bills next year has been computed and found to reach $625,000. This figure represents one-half of the earnings of the company in 1928 in excess of 7½ per cent on its fair value. The new rates, based on this reduction, will be determined by the Public Utilities Commission soon. The company proposes 5.2 cents a kilowatt-hour for domestic consumers, who now pay 5.9 cents.

PLANTS PROGRESS IN ST. LOUIS TERRITORY.—Work is progressing on the enlargement of the Cahokia and Venice (Ill.) steam power plants, across the Mississippi River from St. Louis, which serve customers of the Union Electric Light & Power Company. Demand for electricity has increased so rapidly, the North American Company, the controlling corporation, says, that a 35,000-kw. generator only five years old is being replaced at Cahokia by a 75,000-kw. unit, one of the largest single-cylinder turbo-generators ever built. The same number of boilers will under modern firing methods suffice for the larger unit. The generator removed from Cahokia will supplant two units of 3,000 kw. and 5,000-kw. rating at Venice. These operations, with boiler changes and building alterations, will cost $2,100,000 and will be completed next year.

PHOENIX, ARIZ., TO SET PACE IN CHRISTMAS LIGHTING.—An unusually comprehensive plan for Christmas decorative lighting outdoors is reported from Phoenix, Ariz., where the Salt River Valley Electrical League plans to light the streets for many blocks in all directions from the heart of the city. The city will be divided into four groups, which will each compete for three prizes for the best decorated block and home. Even Christmas carols, to be sung before the lighted homes, are promised.

WINNIPEG VOTERS FAVOR SLAVE FALLS PROJECT.—The ratepayers of Winnipeg, Manitoba, in a plebiscite taken on Nov. 23, approved the construction of additional power units at Slave Falls, on the Winnipeg River, at a cost of $6,500,000, as a development of the City Hydro system. The amount voted is for the initial construction program and will be spent over a period of two and a half years. The complete cost of the plant and the transmission line circuits to Winnipeg has been estimated as $10,528,365, of which sum $8,544,365 will be spent on the power station, dams and tramways and $1,984,000 on transmission lines.

INTERCONNECTION VERSUS KENTUCKY FLOODS.—In spite of the worst flood in years in southeastern Kentucky, with the Cumberland and Powell's Rivers and Yellow Creek on a rampage, the Kentucky Utilities Company maintained electric service without interruption throughout the region from Nov. 16 to 22. This achievement was due to day-and-night effort of the company's operating staff under the direction of Robert M. Watt, district manager. The Cumberland River spread half a mile out of its banks at Pineville, filling the business streets. Yellow Creek, a little stream that ordinarily meanders through Middlesboro, ran 8 ft. deep in the principal street there. Five miles north of Pineville, beside the Cumberland River, sits a 40,000-hp. steam-electric generating station, principal unit in the company's southeastern Kentucky transmission system. A 40-ft. rise in the river in 72 hours brought the water to 18 in. above the ground floor of the power plant. A gang of men began building a dike around the brick structure. Operation was stopped Monday night to conserve coal and release the operating staff to aid the dike builders, and the Dix River hydro plant, 90 miles away, took up the load. Throughout the night all hands toiled. The flood was thwarted. A tree tumbled 125 ft. down a hillside upon a 33,000-volt transmission line connecting the Pocket and Pineville stations. Service was switched instantly to other lines and repairs were made without delay.

NEW 66,000-VOLT LINE TO CLOSE INDIANA POWER LOOP. — Construction has been started on a 66,000-volt transmission line from the Oakdale plant of the Indiana Hydro-Electric Power Company to Kentland, Ind., 45 miles distant. The line will complete a loop and tie in with the Central Illinois Public Service Company's system at the state line. The company will install two transformers with a rating of 4,500 kva. each at the Kentland substation to step down the voltage to 33,000 in order to tie in with the system serving that section.

ULTIMATE CAPACITY OF SEVEN SISTERS FALLS PLANT IN MANITOBA 230,000 HP.—With the completion of a 14-mile railroad from Whitemouth, Manitoba, to Seven Sisters Falls, on the Winnipeg River, work will begin at once on the 135,000-hp. plant that the Winnipeg Electric Company is to build there on its leased site. A. W. McLimont, president of that company, announces that sale of the entire output of the plant is already assured, that it will be rushed to completion in two or three years at a cost of approximately $20,000,000, and that its capacity will ultimately be raised to 230,000 hp.

ELECTRICAL GROWTH IN THE DAKOTAS.—Districts in southwestern North Dakota and northern South Dakota which now get their electrical power from the United Public Service Company are, as the result of improvements and extensions, prepared for almost any emergency which might arise, according to O. W. Mattison, general manager in Bismarck. These improvements include a 3,500-kw. turbo-generator at the Beulah (N. D.) plant and a second 40,000-volt transmission line from that point. The territory supplied by the United Public Service Company extends in North Dakota from Tappen on the east to Belfield on the west and also to Killdeer and to Gettysburg, Lemmon and McIntosh, S. D. Approximately 225 miles of transmission lines were constructed by the company last summer. The Bis-

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

Electrical Credit Association — New York Division, New York, Dec. 17; W. J. Kreger, 261 Broadway, New York.

Empire State Gas and Electric Association—Electric Section, United Engineering Societies Bldg., New York, Jan. 10 and 11. C. H. B. Chapin, Grand Central Terminal, New York.

American Engineering Council—Annual meeting, Washington, Jan. 14 and 15. L. W. Wallace, 26 Jackson Place, Washington.

North Central Electric Association — Engineering Section, Minneapolis, Jan. 21-22; Commercial Section, Minneapolis, Feb. 25 and 26. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 28-Feb. 1. F. L. Hutchinson, 33 West 39th St., New York.

Midwest Power Conference — Chicago, Feb. 12-16. G. E. Pfisterer, 53 W. Jackson Blvd., Chicago.

marck-Driscoll line is connected at Driscoll with the line of the Northern Power & Light Company, also owned by the United Public Service, which extends south as far as Napoleon. The company plans to build distribution systems in Stanton, McKenzie and Sterling this year.

ONTARIO HYDRO WINS FIRST SKIRMISH WITH FOSHAY.—Following a spirited battle in which the chief officers of the Ontario Hydro-Electric Power Commission took part, the ratepayers of Southampton, Ontario, voted on Nov. 26 to authorize the commission to proceed immediately with a survey of the town's electrical requirements and submit estimates in connection therewith. Thus the first skirmish in the small power war between the commission and the Foshay interests of Minneapolis has been won by the Hydro. The American private interests are endeavoring to gain a foothold in several municipalities in Bruce County, including Walkerton and Port Elgin, and votes will also be taken in these places soon. The Foshay company has for several years had small power developments at Wiarton and at Sauble Falls, from which it desires to supply the towns mentioned. Hydro supporters express the fear that if the private company were allowed to serve the public in Bruce County, it would not be long until it would reach out and seek a foothold in territory where the Hydro now has a monopoly.

WEST VIRGINIA PUBLIC SERVICE COMMISSION HEARING RIVAL APPLICANTS FOR NEW RIVER SITE.—Final arguments in the hearing on proposed hydro-electric development of the New River in West Virginia will probably be heard by the Public Service Commission of that state on Dec. 19. The New-Kanawha Power Company, whose project was referred to last week (page 1109), claims to own all the land on both sides of New River for a distance of 4 miles up to and including the site of the proposed dam at New Richmond Falls, with the exception of 50 acres which are owned by its rival, the West Virginia Hydro-Electric Company. New Richmond Falls is 10 miles west of Hinton. The commission has fixed Jan. 3 as the date for the final hearing of the petition of the Raleigh Bridge Power Company for a permit to build a dam and power plant in Raleigh River, about 21½ miles from its mouth.

ANOTHER GENERATING UNIT FOR DAVENPORT AND HER SISTER CITIES.—A new 22,500-kw. Allis-Chalmers turbo-generator will be installed next year in the Riverside plant of the United Light & Power Company at Bettendorf, near Davenport, Iowa, it is announced by R. B. McDonald, president of the "Quad-City" utility companies operated by the United Light. This will require an expenditure of $1,400,000 and give the Riverside plant a capacity of almost 45,000 kw. Work on the addition will begin Feb. 1 and be completed in about seven months.

NEW YORK EDISON COMPANIES' NEW HOME.—The new building of the Consolidated Gas Company at the corner of Fourteenth and Fifteenth Streets and Irving Place, New York City, in which the New York Edison and United Electric Light & Power companies have their offices and which is headquarters

for the consolidated electrical companies of the metropolitan district, is not yet completed, for an extension to the east on Fourteenth Street, where Tammany Hall stood until its demolition a few months ago, is still under way. The main part of the building is finished, however, and its tower has become a striking object in lower New York. The building, of which only the upper portion is shown here, contains 24 stories and is 425 ft. in height from ground to pinnacle.

NEW TRANSMISSION LINES IN ALABAMA AND MISSISSIPPI.—Major construction work has been completed on the transmission line of the Alabama Power Company from Linden to Jackson, in southern Alabama, a project representing an estimated cost of $400,000. Hydro-electric service is already available along the line except at Jackson, the southern terminus, where it is to be established in the next few weeks. Surveys are being made for early construction of another line of the Alabama Power Company from Flomaton to Brewton, Ala. The Mississippi Power Company is planning to erect a 44,000-volt line from Picayune to Poplarville, Miss. This line also will serve the towns of Carriere and McNeil. These communities will be served from the steam plant at Picayune, with probable maintenance of an oil-engine generator at Poplarville as an auxiliary unit.

MARYLAND PUBLIC SERVICE COMMISSION MAY SEEK CHANGE IN LAW.—As an outcome of the recent court decision upsetting the refusal of the Maryland Public Service Commission to allow the Electric Public Utilities Company to acquire four small properties, the commission is likely to seek from the next Legislature an amendment to the law under which it is governed. The law, according to the court decision, says that the commission before denying such an application as that of the Electric Public Utilities Company must find that public welfare would suffer from approval. The commission wants it obligatory upon utility companies to show affirmatively that such purchases will be "for the public benefit."

OREGON RECLAMATION CONGRESS JEALOUS OF WATER-POWER GRANTS.—The Oregon Reclamation Congress has adopted a resolution asking the 1929 Legislature to memorialize Congress to pass an act making the government a party defendant in a suit whereby the state will seek to cancel title held by the California-Oregon Power Company to power canals on Link Creek and a dam site on the upper Klamath Lake. The utility's title to the dam site is in the nature of a 50-year lease, but the canals are held in fee simple by the company and represent approximately 8,000 potential horsepower. The congress also passed a resolution recommending the enactment of state legislation providing that all applications for the use of water for power purposes be first approved by the State Reclamation Commission before being granted by the engineer.

YOUNGSTOWN TO JOIN THE WELL-LIGHTED CITIES.—Youngstown will be one of the best lighted cities in Ohio, and at the same time will spend more money for street lighting than any other city with the exception of Cleveland and Cincinnati, if the new lighting plan suggested by the Pennsylvania-Ohio Power & Light Company is adopted. The plan proposed provides the following standards: Business district, "white way" or

ornamental standards with overhead or underground connections, at least 1,000-cp. lamps, with no limit as to spacing; primary thoroughfares, 1,000-cp. lamps placed overhead every 240 ft.; residential streets, 250-cp. lights placed overhead every 240 ft.; secondary thoroughfares, 600-cp. lamps placed overhead every 240 ft.

UTICA CONTESTS ELECTRIC RATES.—The city of Utica, N. Y., has appealed to the New York Public Service Commission against the new electric rate schedule of the Utica Gas & Electric Company and has engaged Dr. E. W. Bemis of New York to prepare its case, which the commission has set for hearing on Jan. 28.

ALBANY'S NEW GOVERNMENT BUILDING WILL PROBABLY BUY ITS ELECTRICITY.—A story published early in the summer to the effect that the present power plant of the State of New York would not generate sufficient energy to supply the 33-story state office building in course of construction was borne out this week when bids were opened for work incidental to completion of the building. At the office of the Division of Architecture it was said that in all probability electrical energy would be purchased for the new building, unless the State Office Site and Building Commission and the Legislature should determine to enlarge the present plant.

CONCRETE PROTECTIVE APRON ON CONOWINGO DAM COMPLETED.—Completion of the concrete protective apron on the down-stream side of the Philadelphia Electric Company's dam at Conowingo, Md., has just been accomplished, providing protection for 23 additional crest-gate sections of the spillway. When the dam was placed in operation eight months ago this apron included only the three regulating-gate sections and seventeen crest-gate sections of the spillway. Because of high-water conditions in the late fall of 1926 work was postponed on the other 23 spillway sections. The recent low-water season afforded an excellent opportunity to complete the apron. Work was started in September.

ANOTHER GENERATING UNIT FOR SOLD.—The hydro-electric site on the Shenandoah River, one mile south of Shenandoah, Va., has been purchased by the Shenandoah River Power Company from A. A. Roudabush of Shenandoah. The options on all water rights were included. Work on a dam and a 1,200-hp. power plant is expected to start soon, and the company is planning on having the plant in operation by next summer. The dam will be approximately 20 ft. high and, together with the power plant, will cost about $250,000. The Shenandoah River Power Corporation is a subsidiary of the Atlantic Public Service Corporation and operates hydro-electric plants at Woodstock, Edinburg, Timberville, Grottoes and Rockland Mill, Va., and a steam plant at New Market.

Commission Rulings

HYPOTHETICAL DAMAGES NO REASON FOR DENYING APPROVAL OF HYDRO-ELECTRIC PROJECT.—An application from the Empire District Electric Company to the Missouri Public Service Commission for approval of a hydro-electric project across the White River at Table Rock was opposed on the ground that damages would accrue to the surrounding property and that existing roads and bridges would be rendered useless. The Missouri commission, approving the project, said that it did not have authority to go into the matter of settlement of damages, but that it had no reason to believe these could not be settled in a regular and orderly manner by mutual agreement or by appeal to the courts, and for this reason the authorization of the project should not be denied or delayed.

AUTHORITY OF COMMISSION OVER FRANCHISE RATES.—Entire jurisdiction over rates specified in the franchise of the Arvada Electric Company was taken by the Colorado Public Utilities Commission, in granting that company authority to exercise its franchise privileges, despite a protest made against the specified rates. The commission said that, no benefit having been claimed by the company because of the insertion of the rates in the franchise, it stood in the same position as if none had been named. Furthermore, it was the duty of the commission to the public to take such necessary steps as will prevent rates which have been inserted in an ordinance granting a franchise from having any higher standing or securer footing than they would have if they had not been so inserted, notwithstanding the announced intention of the utility to claim no special benefit from such rates.

REDUCED RATES TO STIMULATE CONSUMPTION.—Notwithstanding the fact that the Friday Harbor Light & Power Company was already earning slightly less than the usual rate of return for such a utility, the Washington Department of Public Works authorized a reduction of unusually high rates on the theory that the consumption stimulated would make up any loss in revenue. The department said that it was of the opinion that a reduction in the level of rates would not mean a reduction in the rate of return, but an increase. "The record shows that under the present rates respondent's patrons are using a minimum of electricity," it remarked. "Electricity is regarded as a luxury to be used sparingly, and homes are inadequately lighted. Electric appliances which are regarded as household necessities in other parts of the state are not used in Friday Harbor because of the present high rates. Several large users of electricity have installed private generating plants, which would be discontinued if respondent's rates were reduced."

PROPER PROCEDURE IN CASE INVOLVING ABANDONMENT OF SERVICE.—In a case affecting the Androscoggin & Kennebec Railroad Company the Maine Public Utilities Commission discussed the question whether a utility might discontinue unprofitable service immediately and make the public show cause why service should be restored, or whether the burden of proof should be upon the utility to show just cause for discontinuance before such action was taken. The commission said: "The complaining public ordinarily has no dependable information concerning earnings and other controlling facts and presents its complaint invariably without adequate preparation. Upon it rests a burden it is ill prepared to sustain. On the contrary, in a hearing for consent to abandon, upon the utility's petition, the utility must prove by cogent evidence facts which justify the proposed final termination of its former service. The ultimate consequence to the public is the same where prior consent to abandonment is obtained after a public hearing and where precedent voluntary abandonment by a utility is followed by hearing upon complaint and refusal to order service restored. The former procedure conduces to a complete and more exhaustive hearing."

Recent Court Decisions

DAMAGES FOR INJURY FROM LANDSLIDE SAID TO HAVE BEEN CAUSED BY LEAK FROM HYDRO COMPANY'S PIPES SUSTAINED.—Judgment for the plaintiff in a damage suit of an unusual kind (Williams vs. Public Service Company of Colorado) has been sustained by the Supreme Court of the state named. Damages were sought for the death of a youth caught in a landslide in the neighborhood of the company's pipe line. It was alleged that this pipe line had sprung a leak and that the escaping water had sunk into and undermined the soil on the mountainside and thus caused the slide. The Supreme Court could find no reason for upsetting the jury's findings, holding that the alleged contributory negligence of the victim was a matter for decision by the jurors. That a slide might occur from rains and snows, and without the intervention of human agency, is, the Supreme Court said, apparent. That it probably did occur because of the reason alleged by the plaintiff, and that the defendant knew or might readily have known of the condition said to exist, was fairly deducible from the testimony on both sides. (270 Pac. 659.)*

POWER-TRANSMISSION COMPANY NOT NECESSARILY A PUBLIC UTILITY.—That a power-transmission company limited by its charter to supplying energy for private use, having no franchise, never exercising the right of eminent domain, and purchasing electrical energy for sale to a single company, is not necessarily a public utility was the finding of the Supreme Court of Missouri in State ex rel. Buchanan County Power Transmission Company vs. Baker. In the case at issue it was not shown that the customer to whom electricity was furnished was a public utility, nor that the said customer was not using the electricity for its own purposes, nor that the company making the delivery was an important link in the sale and distribution of electricity. The solitary customer in question—held not to have been proved a utility—was the St. Joseph Railway, Light, Heat & Power Company, and the plaintiff in the suit purchased the energy it sold this company from the Kansas Public Service Company, transmitting it over a private right-of-way. The plaintiff resisted assessments for taxation purposes made by the state authorities against it as a utility. (9 S.W. [2d] 589.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

Dr. Sperry Becomes President of A.S.M.E.

Dr. Elmer A. Sperry, internationally known engineer and inventor, took office on Dec. 7 as president of the American Society of Mechanical Engineers. Dr. Sperry's career covers a period of approximately 50 years, in the course of which he has won frequent recognition for his engineering accomplishments both in this country and abroad. The development of an electric arc light before he was 20 years of age marked the beginning of his scientific activity and following this achievement he turned his attention to dynamos, motors and other apparatus as head of the Sperry Electric Company

E. A. Sperry

of Chicago. Success in the production of electrical mining machinery, street railway cars and in the field of electrochemistry followed and then Dr. Sperry became interested in the gyroscope and its application to the stabilization of ships and airplanes. At the present time he is chairman of the board of directors of the Sperry Gyroscope Company, Brooklyn, N. Y.

Dr. Sperry is the holder of more than four hundred patents on mechanical and electrical devices and the author of many addresses and papers delivered before engineering and technical societies. He has received many awards and decorations, including the John Scott legacy medal and premium, the John Fritz medal, the Franklin medal and the American Museum of Safety medal. He was decorated by Czar Nicholas II of Russia and he received the Order of the Rising Sun from the Emperor of Japan in 1922.

W. W. Barr has been appointed assistant to C. A. Collier, vice-president of the Georgia Power Company. Mr. Barr received his technical education at Marion Institute, Marion, Ala., the University of Alabama and the United States Naval Academy. He became associated with the Tennessee Coal & Iron Company in 1922 and in September of that year joined the sales department of the Georgia Power Company. Since that time he has been steadily advanced and since 1926 he has been manager of the Dublin division of the company. Mr. Barr is president of the Georgia Electrical Association and chairman of the wiring committee of the Southeastern division of the National Electric Light Association.

Kidd Becomes Chairman of British Columbia Board

George Kidd, president of the British Columbia Electric Railway Company, has been named chairman of the board of directors of the British Columbia Power Corporation, the holding company, effective Jan. 1, 1929. Mr. Kidd thus completes a period of fifteen years as head of the British Columbia company. He was educated as a chartered accountant and was appointed secretary of the British Columbia Electric Railway Company at London, England, in 1907. Four years later he removed to British Columbia and acted as comptroller until May, 1914, when he was appointed general manager. The office of general manager was changed to that of president in August, 1923.

W. A. Jones, first vice-president of the Cities Service Company, New York, has been named vice-president and director of the Public Service Company of Colorado.

Jacob F. Schoellkopf, chairman of the board of directors of the Buffalo, Niagara & Eastern Power Corporation, sailed for Europe Sept. 24 aboard the Hamburg-American liner *New York* for a short stay abroad.

Charles A. Stone and Edwin R. Webster of Stone & Webster, Inc., were the guests of honor at a buffet supper given in the Chamber of Commerce clubrooms in Richmond, Va., on Dec. 1, the occasion celebrating the winning of the Charles A. Coffin award by the Virginia Electric & Power Company for distinguished transportation service in 1928. The Virginia utility is operated under the management of Stone & Webster. State, city and Chamber of Commerce officials attended. Addresses were made by E. B. Sydnor, president of the Richmond Chamber of Commerce; John S. Bryan, publisher of the Richmond *News Leader* and twice president of the American Newspaper Publishers' Association; Mr. Stone and Mr. Webster. Among officials of the Virginia Electric & Power Company in attendance were W. E. Wood, president; T. Justin Moore, vice-president and general counsel, and Thomas P. Walker, vice-president.

A. W. Thompson Receives Leave of Absence

Arthur W. Thompson, president of the United Gas Improvement Company, was granted a six months' leave of absence by the board of directors at a special meeting held in Philadelphia Dec. 4. The board's action is attributed to the impaired condition of Mr. Thompson's health. John E. Zimmermann, president of Day & Zimmermann, Inc., has been appointed chairman of the executive committee with temporary full executive powers. Mr. Zimmermann has agreed to accept the assignment upon the condition that he is not committing himself, "nor is the company committing itself by reason of such appointment to any permanent use of his services as an executive officer, he being unwilling to assume any such obligation."

A. W. Thompson

Mr. Thompson had been an outstanding figure in the development of the public utilities in the Pittsburgh district for a number of years when in 1926 he was elected president of the United Gas Improvement Company to succeed Samuel T. Bodine. In addition to this position Mr. Thompson has been serving as chairman of the board of the Philadelphia Electric Company, acquired early this year by U. G. I. interests. While a student at Allegheny College, he engaged in railroading and continued to pursue this branch of public utility work until his affiliation with the Philadelphia Company in 1919. Mr. Thompson has been active in association work and at the present time is a vice-president of the N.E.L.A.

Howard A. Stanley has been appointed vice-president and assistant general manager of the Fall River (Mass.) Electric Light Company. Mr. Stanley is one of the best known utility operating men in New England and has been with the company since 1914 as electrical engineer, assistant general superintendent and general superintend-

ent. Prior to this connection he was superintendent of construction for the New England office of the General Electric Company, with headquarters at Boston, and was previously employed by that organization in Cincinnati, Chicago and Schenectady. He is active in the American Institute of Electrical Engineers, the National Electric Light Association and civic affairs.

Murrin Chief Executive of British Columbia Utility

W. G. Murrin, vice-president of the British Columbia Electric Railway Company, has been named president of that utility to succeed George Kidd, who becomes chairman of the board of the British Columbia Power Corporation, the holding company, effective Jan. 1, 1929. Mr. Murrin began his public utility career in the City of London Electric Lighting Company in 1903. Later he became works manager and electrical engineer of the London United Tramways Company, which concern he left in 1913, removing to British Columbia as mechanical superintendent of his present company. From general superintendent he became assistant general manager in 1916, and was appointed vice-president in 1923.

JOSEPH P. DARATT, for the past 4½ years manager of the Frankfort, Ind., plant of the Northern Indiana Public Service Company, has resigned to affiliate himself with the Cia. Cubana de Electricidad, Inc., of Havana, which is managed by the Electric Bond & Share Company of New York City. Mr. Daratt will sever his connections with the Frankfort property Dec. 15 and will begin his new duties Jan. 1.

M. K. FOXWORTHY, commercial manager of the Indianapolis Power & Light Company, has affiliated himself with John A. George, president of the Indianapolis Coal Company, as a partner in the company. He will become secretary-manager Dec. 1. Mr. Foxworthy, who has spent more than 30 years in active management of leading Indianapolis companies, was vice-president of the Merchants Heat & Light Company before its consolidation with the Indianapolis Light & Heat Company to form the present Indianapolis Power & Light Company.

A. D. CAMERON, manager of the street lighting and supply division of the central-station department of the General Electric Company, has resigned to affiliate himself in an executive capacity with the Electric Household Utilities Company of Chicago. His headquarters will be in New York and his field will cover sales, service facilities, credits, etc., in his territory. The Electric Household Utilities Company manufactures the Thor washing machines, ironers and vacuum cleaners and is associated with the General Electric Company. Mr. Cameron left Nov. 1 for Chicago, where he will remain about a month before removing to New York.

Joseph Bowes Now in Virginia

Joseph Bowes, formerly in charge of the Stone & Webster interests in the El Paso, Tex., district, has been appointed vice-president of the Virginia Electric & Power Company, with headquarters in Norfolk. In this capacity Mr. Bowes is succeeding Thomas P. Walker, who has assumed new duties in Richmond. Mr. Bowes received his technical training at Cornell University, from which institution he was graduated in 1907. When he began work for Stone & Webster two years later, he transferred his interest to the West as superintendent of operations of the light and power department of the Tacoma (Wash.) Railway & Power Company. From 1916 to 1923 he was identified with Stone & Webster utilities in Texas, first as general superintendent at Port Arthur and later as general superintendent of the Eastern Texas Electric Company, with headquarters in

Joseph Bowes

Beaumont. When the property at Lake Charles, La., was purchased, in 1924, Mr. Bowes was selected as manager. Two years later he became general manager in charge of all operations in Louisiana for the Gulf States Utilities Company, the position he occupied until the spring of 1927, when he became manager of the El Paso Electric Company.

H. C. BLACKWELL, president of the Cincinnati Gas & Electric Company, has been elected president of the Cincinnati Electric Club. Mr. Blackwell has been one of the outstanding executives of electric light and power companies in the Middle West, as well as an officer in the representative engineering societies.

GEORGE R. FREER, JR., has been appointed general superintendent of the electric department of the Utica (N. Y.) Gas & Electric Company. Mr. Freer served as acting chief of the electric department for the last six months, succeeding Roy B. McPherson. He joined the company as a draftsman in 1920.

GEORGE W. SCHWANER, formerly county treasurer in Sangamon County, Ill., and at one time collector of internal revenue, has been elected secretary of the three Illinois utilities associations, the Illinois Electric, the Illinois Gas and the Illinois Street Railways. Mr. Schwaner is succeeding the late R. V. Prather of Springfield.

Obituary

Sir Alexander Kennedy

Sir Alexander Blackie William Kennedy, LL.D., F.R.S., who from 1874 to 1889 was professor of engineering at University College, London, and from the latter year onward was engaged in private consulting practice, died Nov. 1, in London, at the age of 81. Sir Alexander was very early associated with electricity supply matters in London and in different parts of the United Kingdom; indeed, he is described as a pioneer in this branch of activity, for he was engineer of the Westminster Electric Supply Corporation from its foundation in 1889 and was connected also with the St. James and Pall Mall and the Central Electric Supply Companies. Edinburgh, Glasgow and many other cities and towns have electricity undertakings for which he acted as consulting engineer, while in the traction department of the industry he acted as electrical engineer to the Waterloo & City Railway and as electrical adviser to the London County Council in connection with early stages of its electric street railway undertaking.

During the past 30 or 40 years Sir Alexander had held the presidency of the Institution of Civil and Mechanical Engineers and of the engineering section of the British Association and had filled the chairmanship of the advisory committee on electric railways under the British Ministry of Transport in 1920, had served on Lord Parker's Committee on Wireless Telegraphy in 1913, and rendered special service in various matters during the war.

WALTER J. KLINE, construction engineer with the American District Steam Company, North Tonawanda, N. Y., died Nov. 17. Mr. Kline had been affiliated with the company for approximately 30 years.

CLARENCE R. LININGER, who for the last 25 years had been employed by the Pittsburgh Transformer Company and its successor, the Allis-Chalmers Manufacturing Company, died at his home in Glencoe, Ill., Nov. 27, after an illness of several months. Beginning as a bookkeeper for the transformer company in its early days, Mr. Lininger rose to the position of Western district manager at Chicago, the company's most important branch office. About thirteen years ago Mr. Lininger formed and had since operated the Royal Electric Manufacturing Company, of which he was president. He was a member of the Western Society of Engineers and many other engineering and social organizations.

Financial and Statistical News

How Anglo-American Merger Is Being Financed

Details of the scheme for financing the Anglo-American electrical combine, of which Metropolitan-Vickers forms the core, have now been made public. The purchase of 1,920,000 of the 2,000,000 issued ordinary shares of the British Thomson-Houston Company from the International General Electric Company of America is to be effected by a payment at the rate of 12s. ($3 per share) of £1,152,000 ($5,760,000) in Metropolitan-Vickers ordinary shares. This payment will give the American company roughly one-third of the ordinary capital of the new combine; 887,214 shares of the 957,177 ordinary 4s. shares of Edison Swan Electric Company, and virtually all the £150,000 ($750,000) paid-up ordinary and preference capital of Ferguson, Palin, Ltd., is to be acquired by a payment of £969,186 ($4,845,930) in cash, toward which, and also to provide further working capital, Metropolitan-Vickers is to issue a further 1,136,950 ordinary shares. The new issue and the conversion of the existing 500,000 deferred 1s. (25-cent) shares will increase the ordinary share capital of the company to £3,450,900 ($17,254,500).

Net Profits of 392 Companies Up 10.99 per Cent

Total net profits of 392 companies in twenty-one lines of industry and miscellaneous amounted to $2,268,106,000 in the first nine months of 1928, compared with $2,043,491,000 in the corresponding period of 1927, an aggregate gain of 10.99 per cent, according to a compilation prepared by Ernst & Ernst, accountants, from published financial statements. Industrials lead the list with an increase of 19.17 per cent. Public utilities follow with a gain of 11.97 per cent. A group of 125 railroads report an income, before certain charges but on a comparable basis, 3.02 per cent higher than in the same nine months of 1927.

Extra Dividends Declared

Directors of the Duke Power Company have declared an extra dividend of 1 per cent on the common stock and the regular quarterly dividends of 1 per cent on the common and 1¾ on the preferred, all payable Jan. 2 to holders of record Dec. 15. The Public Service Corporation of New Jersey has declared an extra dividend of 40 cents per share on the outstanding no-par value common stock in addition to the regular quarterly dividend of 50 cents per share, both payable Dec. 31 to holders of record Dec. 7.

The directors of the Ingersoll-Rand Company declared a special extra dividend of $1 per share on the common stock, no par value, and the regular semi-annual dividend of $3 per share on the preferred stock. The extra dividend is payable Dec. 21 to holders of record Dec. 10 and the preferred dividend Jan. 2 to holders of record Dec. 10.

Directors of the Associated Gas & Electric Company voted an extra cash dividend of 40 cents and the regular quarterly dividend of one-fortieth of a share of class A stock on class A shares. The Maytag Company ordered an extra payment of 50 cents a share in addition to the regular quarterly payment of 37½ cents on common stock. Directors of the Utilities Power & Light Corporation declared an extra dividend of 17-200 of a share of class B stock on class B, as against the previous extra distribution of one-fortieth of a share.

The General Gas & Electric Corporation has declared an initial dividend of 50 cents in cash on dividend participations, an extra dividend of 50 cents a share in cash on class A common stock and an extra cash dividend of 50 cents a share on the class B common stock. Regular dividends were also declared on the class A common and the class B common. The American Gas & Electric Company has declared a 50 per cent stock dividend on the common stock, in addition to the usual semi-annual disbursement of 2 per cent in stock and the regular quarterly cash dividend of 25 cents, all payable Jan. 2 to holders of record on Dec. 12. A year ago the company disbursed a 40 per cent stock dividend.

Private Ownership Under Public Regulation Advocated*

Utility Securities Association Head Discusses Advantages of Private Ownership and the Functions and Various Problems of Regulatory Bodies

By Milton W. Harrison
President National Association of Owners of Railroad and Public Utility Securities

THE National Association of Owners of Railroad and Public Utility Securities, organized more than eleven years ago and representing about ten billion dollars of securities, grew out of the increasing recognition by the larger trustee holders of such securities of their direct responsibility in helping to conserve stability of the fair return of those industries devoted to meeting the daily needs of millions of people. These larger trustee investors, as well as individual investors, functioning through the association also recognize that public regulation has a direct relationship to stability of fair return, and that it was adopted, first, to provide to the public the benefits of the elimination of wasteful and cut-throat competition; second, to assure the public that unreasonable charges would not be made for services universally demanded.

In this country the sound and extensive development of railroad transportation and other public utilities has been due to private incentive and initiative. The American public is convinced that the greatest efficiency and economy in the operation of these enterprises will continue to flow from private ownership and management. The function of public regulation is to check bad tendencies, to correct evils which may injure service and credit; to insure reasonable charges, and, with particular reference to carriers, fairly to arbitrate differences between groups of interests when they appear to be in irreconcilable conflict. The function of management is to render the highest quality of service for the least expense, operating in accordance with the rules of the business which has grown out of experience and the regulations imposed by the public in the interests of fair play. When regulatory bodies pass beyond their proper functions, and get over into the realm of management, they court disaster for the business involved, inviting serious loss and inconvenience to the community served. When management ignores the functions of judicial and fair regulation in the interests of good feeling and equitable treatment as between customers, security owners, wage earners and management, they, too, are courting the disaster almost certain to follow peremptory and sometimes ill-advised action by an angry constituency.

Regulatory authority represents the public, the industry and the security owner, not one of these to the exclusion of the others but all together. In the determination of its policies of regulation, the regulatory authority must recognize the spirit of fair dealing in respect to the interests of all parties concerned in the development of industry. It is regrettable that regulation is sometimes hampered by too many laws to administer, by the pressure of politics and

**From an address presented at the annual convention of the National Association of Railroad and Utilities Commissioners.*

by inadequate appropriations. Commissions strive for fair treatment, and where they are helpless to give it, where they are interfered with or blocked in their earnest endeavors, the public, industries, labor and security owners all suffer eventually.

I have great sympathy and respect for the Interstate Commerce Commission. Sympathy when Congress calls upon it for the impossible, respect and admiration for its devotion to a multitude of tasks. The pressure of the multiplicity of administrative laws tends to make regulation unwieldy and at times brings grave concern lest unsound policies may emerge from the welter of detail thrust upon the commission. Congress should find some way to relieve the commission.

Business Based on Confidence

The antiquated doctrine that a person or concern is dishonest until proved honest has no place in our system of law, is contrary to the genus of American government and is frowned upon by all fair-minded commissions. I speak for security owners who have invested their funds, most of which are trustee funds, with confidence in the managements of the industries responsible for the securities held. American business has been developed on the basis of the utmost confidence among the people concerned. Honesty is taken for granted. Any breach of faith, after proof, must be dealt with summarily.

Our government is committed to the encouragement and greatest stimulation of agricultural and industrial development. It is well accepted among the people that they desire to sustain that sort of government which will protect citizens in the exercise of initiative and which will guarantee maximum freedom in enterprise. Proper regulation makes business free. Sound government recognizes the necessity for the development and protection of private credit. Diminution of incentive and initiative reduces the potentialities of government credit which does not grow of itself, but only in so far as private credit is developed. Government credit can only be increased in proportion to its ability and capacity to tax private credit. Therefore, regulation must ever be mindful to protect to the utmost this ever-increasing private credit based upon incentive and initiative.

I take exception to the ideas expressed in the minority report on government ownership before this body at its last convention, which stated that "the policy of public ownership and operation must await gradual development under the slow processes of evolution."

We are in a period of changing conditions, at the crossroads, so to speak, and must decide whether we will enter upon the road toward government ownership or continue in the path of private ownership. For my part, I would not take the former, which might seem to be the easier way. It is true that to travel the path of private ownership and to maintain equilibrium between regulation and regulated industries will require greater intelligence and most scientific treatment. But the benefits to the public will be infinitely greater than under government ownership.

I have a high degree of confidence that those who have charge of regulation of our utilities and railroads will, with faith, wisdom and courage, be able so to adjust their regulatory policies as to stabilize regulation.

With the belief on the part of commissions that private ownership and its regulation can be brought to a state of equilibrium, they can maintain a fair return and encourage even greater efficiency and economy in operation. The consuming public will be the chief beneficiary of such a policy, the government will retain its taxing capacity and the railroads and public utilities will be able to raise the large amount of capital necessary to keep pace with a continuance of the growth which has made our country preeminent among the nations of the world.

I can foresee the day when there will be many millions of individual owners of the securities of regulated industry because regulatory authority will assist in sustaining the confidence of the investing public. The life insurance companies, with their two and one-half billions of railroad and public utility securities, have as policy holders more than seventy millions of people dependent upon the integrity of such investments. There are more than thirty-five million savings depositors interested in over two billions more of public utility and railroad securities.

Customer Sales Heavy

The utilities have had wide success in the distribution of their securities to their customers. Continued availability of these great reservoirs of capital insure the greatest measure of domestic comfort and lessened toil to the public. I would rather trust to a system which contemplates ultimately each individual a capitalist than to government ownership for the development of the greatest measure of public contentment. A spirit of hostility toward the industries upon which our economic and industrial progress are so dependent should not be engendered by an assumption that utilities generally are guilty of misconduct before they are proved so. If certain practices not regarded as in the public interest have been made possible because unwieldy legislation has impeded regulation, should not the sponsors of such regulation shoulder their responsibility? If there is accurate knowledge of subtle and insidious propaganda on the part of those who favor experimenting with government ownership as a panacea, in justice why should there not be every effort on the part of those who believe sincerely in the proved benefits of private ownership to sustain that belief before the public? Those who believe that the greatest measure of prosperity and happiness of the families of this country will come from the further development of private ownership and the encouragement of initiative and incentive among the people owe it to the public to broadcast their convictions.

Middle West Utilities to Sell Stock

Directors of the Middle West Utilities Company at a meeting held Dec. 3 voted to offer to stockholders of all classes of record Jan. 2, 1929, the right to buy one share of new common stock for every six shares held at $130 a share. The stockholders voted on Dec. 1 to increase the authorized common stock from 750,000 to 1,250,000 no-par shares and the authorized no-par $6 series of cumulative preferred stock from 250,000 to 500,000 shares.

The outstanding stocks include 600,970 common shares, 307,000 prior lien 7 per cent preferred, 65,000 prior lien $6 series preferred, 400,000 7 per cent preferred and 170,000 $6 series preferred stock, or 1,542,970 shares. The offering of one new share for each six shares held will thus entail the issuance of a maximum of 257,162 new common shares, which, at $130 a share, will provide $33,431,060 new capital.

Subscription warrants are to be issued about Jan. 15 and subscriptions will close on Feb. 15. The subscribers will have the option of choosing between one, four and ten payment plans.

Five Utility Offerings Made

New offerings of electric light and power securities during the first week of December numbered five, one being a Canadian issue. The Commonwealth Utilities Corporation made an offering of 6 per cent convertible gold debentures, series A, to the amount of $2,500,000, the price being 99 and interest, yielding over 6 per cent. Proceeds will in part provide funds to reimburse the corporation for expenditures made or indebtedness incurred, for the acquisition of securities and for other corporate purposes. These debentures are convertible at the option of the holder on or after Nov. 1, 1929, into shares of common stock class B.

With the purpose of retiring maturing obligations the United Public Service Company made an offering of 6½ per cent gold debentures at 100 and interest, yielding 6.50 per cent, a piece of financing involving a total of $4,000,000. Each debenture carries a non-detachable warrant entitling the holder to purchase on or before Oct. 1, 1933, at $15 per share, common stock (without par value) in the ratio of five shares of common stock for each $1,000 principal amount of debentures.

First lien and unifying mortgage gold bonds of the Consumers Power Company were offered to the amount of $11,415,100 at 97 and accrued interest, to yield over 4.65 per cent. These bonds are secured by a direct mortgage, subject to the liens of underlying mortgages as to part of its property, on all the physical property of the company and by the pledge of a large amount of underlying bonds.

The Pacific Public Service Company issued 57,000 shares of class A common stock at $20 per share, to yield 6½ per

cent. Proceeds will be used for the fulfillment of obligations incurred in connection with the acquisition of stocks, for working capital and for general corporate purposes.

The Quebec Power Company made an offering of first mortgage and collateral trust sinking fund gold bonds at 97 and accrued interest, to yield about 5.18 per cent, a piece of financing involving a total of $12,000,000. Proceeds will be used to liquidate indebtedness and to defray cost of additions and improvements.

SWISS UTILITY DECLARES INITIAL DIVIDEND.—An initial semi-annual dividend of $3 per share per annum has been declared on the $6 cumulative preferred stock of the Swiss-American Electric Company of Zurich, Switzerland, payable Nov. 1 to holders of record Oct. 26.

SERVEL TO INCREASE CAPITALIZATION.—Holders of voting trust certificates for preferred and common stock will vote Dec. 21 on increasing the authorized common stock, no par value, from 900,000 shares to 1,600,000 shares. The 65,000 shares of preferred stock (par $100) remain unchanged.

SOUTHERN CANADA POWER TO INCREASE STOCK.—The Southern Canada Power Company has called a special meeting of stockholders for Dec. 21 to vote on a proposed increase of the capital stock and a four-for-one split-up of the present common stock.

Utility Securities Listed

There have been placed on the Boston Stock Exchange list Bankers Trust Company certificates as depositary, representing 400,000 shares (par $50) convertible class A stock of the American Cities Power & Light Corporation, optional dividend series, and 400,000 shares, without par value, class B stock. The New York Stock Exchange has authorized the listing of 238,289 additional shares of common stock of the American Power & Light Company on official notice of issuance and distribution in payment of a stock dividend; 653,883 shares of $5 preferred stock, series A, now outstanding in the hands of the public, and 19,174 shares of $5 preferred stock, series A, on official notice of issuance in exchange for common stock of the Montana Power Company; 317,609 shares of $5 preferred stock, series A, stamped, now outstanding in the hands of the public; 82,391 shares of $5 preferred stock, series A, stamped, on official notice of issuance, making the total amounts applied for 2,324,047 shares of common stock, 673,057 shares of $5 preferred stock, and 400,000 shares of $5 preferred stock, stamped. The New York Stock Exchange has also authorized the listing of 5½ per cent debentures, series B, of the North American Edison to the amount of $20,000,000. The Los Angeles Stock Exchange has authorized the listing of 4,000 additional shares of common stock, par $25, of the Pacific Gas & Electric Company, increasing the amount listed to 2,859,108 shares out of an authorized issue of 8,000,000 shares, of which 2,840,475 shares are outstanding. The San Francisco exchange authorized the listing of 4,000 additional common.

Slight September Increase in Customer-Ownership Sales

September sales of electric utility companies' stock directly to customers and other local buyers continued at a level that was still low, but substantially above that of the two preceding months, according to reports received by the ELECTRICAL WORLD. On the basis of those returns the value of securities thus marketed is estimated at $8,819,000, the number of shares at 116,500 and the number of transactions at 10,470. The average per transaction was therefore about $840, or well within the usual range.

While a large proportion of the shares were of preferred stock selling at or close to $100 per share, about a fourth of the number were in the low-priced group sold at $25 to $30. The only unusual feature reported was the sale of some shares of no-par common at a very low price, apparently in connection with an issue of preferred stock of the same company.

Only one company reported sales exceeding $2,000,000; one other exceeded $1,000,000, and a third closely approached that figure. This is in contrast to some months, particularly in 1927, when $5,000,000 campaigns were not unknown. By far the larger number of companies reported no sales.

Current Earnings Reports of Electric Light and Power Companies

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
American Water Works & Electric & Subs. (Year ended Sept. 30)					
Gross earnings	$50,318,043	$48,255,709	4.3	52	52
Net earnings	24,273,989	23,054,210	5.3	..	..
Associated Gas & Electric (Year ended Sept. 30)					
Gross earnings	41,864,773	33,767,452	24.0	55	53
Net earnings	18,603,983	15,847,534	17.0	..	..
Blackstone Valley Gas & Electric & Subs. (Year ended Oct. 31)					
Gross earnings	6,016,029	5,902,601	1.9	62	64
Net earnings	2,294,276	2,119,360	8.3	..	..
Cities Service (Year ended Oct. 31)					
Gross earnings	33,863,775	32,344,438	4.7	..	..
Net earnings	32,714,666	31,244,251	4.7	..	..
Columbia Gas & Electric & Subs. (Year ended Sept. 30)					
Gross earnings	103,922,080	96,746,522	7.4	58	59
Net earnings	43,946,673	39,359,805	11.6	..	..
Commonwealth Power (Year ended Oct. 31)					
Gross earnings	57,438,341	52,648,976	9.1	52	53
Net earnings	27,751,744	24,500,821	13.3	..	..
Consumers Power (Year ended Oct. 31)					
Gross earnings	29,693,991	26,278,782	13.0	50	52
Net earnings	14,866,270	12,753,317	16.6	..	..
Detroit Edison (Year ended Oct. 31)					
Gross earings	42,527,108	38,532,371	10.4	66	69
Net earnings	14,466,251	11,962,233	20.9	..	..
Eastern Texas Electric & Subs. (Year ended Oct. 31)					
Gross earnings	7,780,125	7,017,294	10.9	60	63
Net earnings	3,082,100	2,568,955	20.0	..	..
Engineers Public Service & Subs. (Year ended Oct. 31)					
Gross earnings	31,060,045	29,159,037	6.5	59	61
Net earnings	12,779,606	11,224,832	13.8	..	..
Galveston-Houston Electric & Subs. (Year ended Oct. 31)					
Gross earnings	5,232,683	5,008,541	4.5	67	59
Net earnings	1,702,420	1,521,339	11.9	..	..
Kansas City Power & Light (Year ended Oct. 31)					
Gross earnings	$13,587,289	$12,153,038	11.7	51	49
Net earnings	6,619,341	6,128,398	8.0	..	..
Milwaukee Electric Railway & Light (Year ended Sept. 30)					
Gross earnings	28,596,755	26,913,445	6.2	67	69
Net earnings	9,479,350	8,410,911	12.7	..	..
Penn-Ohio Edison & Subs. (Year ended Oct. 31)					
Gross earnings	26,389,432	25,607,050	3.0	59	64
Net earnings	10,646,463	9,258,279	14.9	..	..
Portland Electric Power (Year ended Oct. 31)					
Gross earnings	12,475,259	12,127,976	2.9	60	60
Net earnings	5,027,274	4,869,403	3.2	..	..
Puget Sound Power & Light & Subs. (Year ended Oct. 31)					
Gross earnings	15,126,118	14,676,018	3.1	57	58
Net earnings	6,513,966	6,263,027	4.0	..	..
Southern California Edison (Year ended Oct. 31)					
Gross earnings	34,323,240	30,399,571	13.0	32	33
Net earnings	23,113,970	20,446,522	13.0	..	..
Tennessee Electric Power (Year ended Oct. 31)					
Gross earnings	13,253,475	12,437,744	6.6	52	54
Net earnings	6,343,063	5,741,706	10.5	..	..
United Light & Power & Subs. (Year ended Sept. 30)					
Gross earnings	88,980,046	82,509,062	7.8	59	61
Net earnings	36,291,434	31,527,712	15.1	..	..
Virginia Electric & Power & Subs. (Year ended Oct. 31)					
Gross earnings	16,072,270	15,374,244	4.5	57	59
Net earnings	6,852,375	6,201,607	10.5	..	..
West Penn Electric (Year ended Sept. 30)					
Gross earnings	37,776,558	36,871,533	2.5	..	..
Net earnings	17,261,074	16,641,203	3.7	..	..

Business News and Market Conditions

Installment Plan Is Factor in Our Prosperity

That the installment plan is one of the main props of the nation's prosperity and that it is directly responsible for lifting drudgery from millions of American homes through its part in introducing the washing machine and the vacuum cleaner, members of the Electrical Credit Association were told recently by Roman J. Greil, an official of the Commercial Investment Trust organization.

"In all ages mechanical inventions have encountered a certain amount of natural resistance on the part of the public, accustomed to have the work done by older means," Mr. Greil said. "Nothing has been more decisive in overcoming instinctive conservatism of the average family than the modern merchant's readiness to let the purchaser have the use of the new machine while he is paying for it on the installment plan. It demonstrates a conviction on the part of the seller which inspires confidence in the buyer."

Declaring that more than two hundred million dollars' worth of labor and time-saving electrical appliances will be bought on the time-payment plan during the present year, Mr. Greil warned the association members that all figures of current sales would be made to seem puny by comparison with what the next few years will show. "Our people are now thoroughly converted to the principle of letting electricity perform all of the laborious tasks around the home and new appliances which our scientists are working on will be taken up by the public as fast as they are perfected. In your desire to set new sales records, there is but one danger to look out for. Too often the electrical merchant, through the use of high-pressure methods, has sold the installment plan and failed to sell the appliance."

Delinquent Electrical Accounts

(Data Supplied by National Electrical Credit Association)

Division	October 1927	October 1928	Per Cent Increase or Decrease	Ten Months 1927	Ten Months 1928	Per Cent Increase or Decrease
New York	267	271	+1.50	3,136	2,940	—6.25
Middle and Southern Atlantic	139	199	+43.2	1,685	1,925	+14.2
New England	148	122	—17.6	1,552	1,316	—15.2
Pacific Coast	17	12	—29.4	169	125	—26.1
Central	794	653	—17.8	9,017	7,550	—16.3
Total	1,365	1,257	—7.91	15,559	13,856	—10.9

TOTAL AMOUNTS REPORTED

	October 1927	October 1928	Per Cent Increase or Decrease	Ten Months 1927	Ten Months 1928	Per Cent Increase or Decrease
New York	$36,521	$41,382	+13.2	$488,068	$421,895	—13.5
Middle and Southern Atlantic	23,217	28,230	+21.6	206,063	247,810	+20.3
New England	19,079	18,063	—5.3	183,181	164,422	—10.2
Pacific Coast	1,239	717	—42.1	20,238	17,129	—15.4
Central	76,550	74,909	—2.14	991,845	839,063	—10.4
Total	$156,606	$163,281	+4.26	$1,889,395	$1,740,319	—7.89

AVERAGE AMOUNTS

	October 1927	October 1928	Ten Months 1927	Ten Months 1928
New York	$137	$152	$1,563	$1,452
Middle and Southern Atlantic	167	141	1,235	1,286
New England	128	148	1,181	1,253
Pacific Coast	73	59	1,474	1,218
Central	96	115	1,111	1,174

Some Business Aspects of Fascism

REGARDLESS of what may be the opinion of Fascist methods held abroad, close observation of conditions in Italy establishes the fact that Mussolini knows his people and has achieved some almost miraculous results already in the readjustment of economic and industrial conditions, Dr. Julius Klein, Director Bureau of Foreign and Domestic Commerce, told a group of editors of the McGraw-Hill Publishing Company last week. This has been felt by the United States and other countries in their export trade with Italy and with the Near East and other Italian markets.

Italy's aim is to improve economic conditions and almost every legislative change that has been brought about has been toward this end, Dr. Klein pointed out. Italian business leaders have taken an aggressive place in the formation of international cartels, many of which originated there. It is significant that the new president of the International Chamber of Commerce is an Italian.

A strong attempt to put Italy on its own feet is exemplified in the Mussolini policy of currency stabilization and correction of the unfavorable trade balance. In respect to the former, a great improvement has been made, although there were certain unfortunate repercussions, such as a cut in exports and a reduction in the automobile trade; it also tempted people to buy more goods abroad and increased unemployment. Italy has today about 26,000 unemployed, which, however, represents a less serious situation than exists in most of the major European countries.

A serious attempt was made to improve the unfavorable trade balance and the excess of imports has already been cut from 51 per cent to 33 per cent. This has an important bearing on United States trade. Our exports to Italy, however, have increased by almost 100 per cent since 1913. Italy is making trade treaties with the Balkans and the Near East and is also courting South America, where she now occupies a decidedly favorable position.

Of interest both to American manufacturers and lenders of capital is Italy's amazing development in water power. Since 1913 her kilowatt-hour consumption has quadrupled to a present total of over eight billions. Naturally this makes Italy an interesting market for equipment, especially for industrial plants.

At the present moment Mussolini has under way a $500,000,000 public works program involving an increase in arable land and the construction and improvement of the highways. It is also directed to the large-scale improvement of agriculture—to promote irrigation, drainage, etc. There has already been a 25 per cent increase in wheat production, a slightly larger growth than that of the population.

"All these factors," said Dr. Klein, "make it worth while for the American business man to keep a close watch on Italy's growth and the gradually changing needs of her population."

Market Conditions

THE final month of a very favorable year for the electrical equipment industry opens with volume well up to the previous trend in almost all sections. In certain districts, such as the Southeast, orders are small, but the total volume is average. In the Eastern district power companies are making extensive purchases of transformers, switchgear, etc. New England manufacturers also report a number of equipment orders from central stations. One order was for $85,000.

Small motor and other equipment orders constitute the week's business in the St. Louis district, while in the Middle West a few quite large orders, including a cable order for $1,750,000, are recorded. On the Pacific Coast power companies seem to be the largest buyers this week, orders including all manner of central-station equipment. Business has slowed down somewhat in the North.

Lead Price Advanced to 6½ Cents

An advance in the price of lead from 6.35 cents to 6.50 cents, New York basis, accompanied by heavy buying on one or two days has been the only outstanding feature of a very quiet week in the nonferrous metal markets. Sales of copper have been the smallest in several months. Zinc price is firmly established at 6.35 cents, though buying has slackened considerably since the first of the month. Tin advanced to 53¼ cents on Monday, the highest price in several months, but has experienced a precipitous decline subsequently.

NEW YORK METAL MARKET PRICES

	Nov. 28, 1928 Cents per Pound	Dec. 5, 1928 Cents per Pound
Copper, electrolytic	16	16
Lead, Am. S. & R. price	6.35	6.50
Antimony	9.875	9.875
Nickel, ingot	35	35
Zinc, spot	6.6875	6.70
Tin, Straits	52.75	51.50
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price Dec. 5, 1928, 17¼ cents.

Small Equipment Orders Feature St. Louis Business

General conditions in the St. Louis district indicated in reports for November have continued with no apparent decrease in the volume of business. Manufacturers are unanimous in saying that the demand for stock sizes of apparatus continues exceptionally good. Contracts were closed for a lot of power house auxiliary equipment costing $12,000 and a switchboard with panels and oil switches costing $15,000. A 1,200-hp. synchronous motor and 34 small motors to cost $15,000 for an oil refinery, two motors of 500 hp. and two motors of 200 hp. costing $10,000 were sold to a paint company and a lot of mill motors from 2 to 75 hp. to a steel company costing $22,000. Construction projects are as follows:

The United Cold Storage Company, Chicago, plans an addition to its ice-manufacturing and cold storage plant at Kansas City, Mo., to cost $1,000,000. The United States Engineer Office, Kansas City, Mo., will receive bids until Dec. 14 for two engines, tandem compound type. The Titanium Pigment Company, St. Louis, plans an addition to its power plant at Luxemburg, Mo., to cost $35,000. The Wilcox Oil & Gas Company, Bristow, Okla., plans an oil refining plant to cost $150,000. Tulsa, Okla., plans extensions in its municipal street lighting system. The Arkansas Cold Storage Company, Little Rock, Ark., plans an addition to cost $100,000. The Seaman-Dunning Corporation, Pine Bluff, Ark., will build an addition to its automobile body plant, to cost $100,000. Austin, Tex., plans extensions in its municipal power plant to cost $300,000. The Texas Company, Houston, Tex., plans an oil refinery at El Paso, Tex., to cost $1,000,000. The Humble Oil & Refining Company, Houston, Tex., plans a gasoline refining plant at Neches, Tex., to cost $150,000.

Power Companies Order Equipment in Southeast

Very few large individual orders are reported for the Southeast, but the total volume of business is satisfactory. A power company in North Carolina placed two orders for high-tension insulators totaling $50,000, while another power company asked bids on equipment for a substation job to cost $150,000 and orders will probably be placed within the next two weeks. Some other central-station orders were for transformer coils amounting to $3,500 and small switching equipment amounting to $2,650. A power company in the Carolinas ordered three 250-kva. transformers for an industrial installation.

A coal and iron company in Alabama ordered mine motor equipment costing $25,000 and a textile plant in South Carolina ordered a 1,000-kw. turbine. An order was placed by another mill in South Carolina for $2,500 worth of mill wiring materials. Wiring supplies totaling $6,000 were ordered for a commercial building job in Atlanta and weatherproof copper wire amounting to $1,500 was ordered from Charleston by the government. The Goodrich Rubber Company will purchase a cotton mill at Thomaston, Georgia, and will treble its capacity. Construction projects are as follows:

Milton E. Marcuse, president of the Bedford Pulp & Paper Company, Big Island, Va., has organized a company to construct and operate a hydro-electric power plant on the James River. The Shenandoah River Power Corporation, Harrisonburg, Va., plans a hydro-electric power plant on the Shenandoah River, near Shenandoah, Va., to cost $300,000. The Galley Power Company, Charleston, W. Va., plans a hydro-electric power plant on the Galley River to cost $500,000, with a transmission system. John A. Shafer, Illinois Building, Indianapolis, Ind., engineer, is in charge of a proposed hydro-electric power project on Rockcastle Creek in northern Kentucky, to cost $450,000. The Estill Springs Sand & Gravel Corporation, Estill Springs, Tenn., will make extensions in its plant to cost $50,000. The Lamson & Sessions Company, Cleveland, will soon ask bids for a bolt and nut manufacturing plant at Birmingham, Ala., to cost $150,000. The Alabama Power Company, Birmingham, Ala., plans a transmission line between Brewton and Flomaton, Ala., about 15 miles, and a power substation at Brewton and will make additions in transmission lines near Maysville, Ala. The Standard Hosiery Mills, Burlington, N. C., will make expansions to cost $400,000. The Wilmington Naval Stores Company, Wilmington, N. C., plans a turpentine and rosin plant, to cost $150,000. The Republic Iron & Steel Company, Youngstown, Ohio, has authorized the electrification of its mill and will make extensions in its plant near Birmingham, Ala., to cost $5,000,000. The Mutual Light & Water Company, Brunswick, Ga., plans extensions in its plant and system to cost $200,000.

Volume of Sales Increases in Middle West

The volume of business transacted is gradually increasing in the Middle West, most industries indicating a substantial gain during November. Industrial activity is good, the steel and automotive industry are prospering and car loadings are high and quite diversified. Reports from two large mail order houses in Chicago show a gain in sales of 21 per cent, indicating a favorable condition in the agricultural districts. Utility companies are busy with maintenance work, while considerable purchasing of materials for 1929 delivery is going on. Interesting orders placed include paper and lead covered cable valued at $1,750,000, 200 25-kva., 200 37½-kva., 100 50-kva., 100 75-kva., 50 100-kva., 40 150-kva., 20 200-kva. pole type distribution transformers and four 600-amp. and six 1,200-amp. 88-kv. S.P.S.T. frame-mounted oil circuit breakers. Jobbers' sales are generally satisfactory. Construction projects are as follows:

Manitowoc, Wis., will build an addition to its municipal electric light and power plant to cost $250,000. The Wisconsin Valley Power Company, Wausau, Wis., will erect a 44,000-volt transmission line from Rhinelander to Minocqua, Wis. The Detroit Edison Company, Detroit, plans an outdoor switching station at Bunce Creek, Port Huron, Mich., to cost $300,000. Allegan, Mich., plans a municipal hydro-electric power plant to cost $400,000. The Chicago Job Press, Chicago, plans a printing plant to cost $80,000. Chicago Heights, Ill., plans an appropriation for an ornamental lighting system to cost $1,000,000. Decatur, La Grange and Cicero, Ill., plan ornamental lighting systems. The Joliet Steam Dial Company, Joliet, Ill., will build a plant to cost $75,000. The Waukegan Generating Company, Waukegan, Ill., a subsidiary of Public Service Company of Northern Illinois, contemplates an addition to its power plant, to cost $1,000,000. The Auburn Automobile Company, Auburn, Ind.,

plans extensions in its plant at Connersville, Ind., to cost $300,000. The Columbia Canning Company, Cambria, Wis., plans a factory at Shelbyville, Ind., to cost $115,000. The Schwitzer-Cummins Company, Indianapolis, Ind., plans an addition to its mechanical fan manufacturing plant, to cost $50,000. Akron, Ohio, plans a beacon and flood lighting system at its municipal airport, to cost $750,000. The Ohio Bell Telephone Company, Canton, Ohio, plans an underground cable system between Canton and North Canton, to cost $60,000. The Crowe Manufacturing Company, Cincinnati, Ohio, plans expansions in its saw manufacturing plant to cost $200,000. The Edward Ford Plate Glass Company, Rossford, Ohio, plans an addition to cost $2,000,000. The Newton Steel Company, Youngstown, Ohio, plans additions to its plant to cost $600,000. Buffalo, Minn., contemplates a municipal electric light and power plant. The Diamond Iron Works, Minneapolis, Minn., plans a plant addition to cost $100,000. The Grau-Curtis Company, Minneapolis, Minn., will build an addition to its furniture factory to cost $100,000. The Central Power Company, Grand Island, Neb., will build a transmission line from Shelton to Kenesaw, Neb. The Sinclair Refining Company, Kansas City, Mo., plans an oil storage and distributing plant at Nebraska City, Neb., to cost $100,000. The Municipal Utilities Company, Des Moines, Iowa, plans a power plant and system at Marengo, Iowa, to cost $150,000.

Power Company Demand Leads in Eastern District

Power companies are entering the market for equipment in the Eastern district and transactions are trending upward rapidly. While substation and affiliated equipment is taking the lead at the moment prime movers and other heavy machinery are expected to be in demand shortly. A metropolitan central station has contracted for transformers of 18,000-kva. rating, with accessory apparatus, totaling $116,000, for railway electrification service. An eastern Pennsylvania power company has placed an order for three transformers, switchgear and auxiliaries to cost $100,000. An Alabama central station has made an award to an Eastern manufacturer for a 6,000-kw. non-condensing steam turbo-generator and is expected to purchase other equipment, including switchboard apparatus. A Brooklyn power company has contracted for a quantity of network protectors to cost $230,000.

Iron and steel mills, both in the Middle West and Southern districts, will soon be in the market with requirements for expansion programs. Motor business is fair, with indications for an early improved demand. Ice-manufacturing and refrigerating plants have been active purchasers.

Motor-generator sets are securing good inquiries for forthcoming installations, but immediate commitments have slackened. A New York hotel will soon make an award for three 600-kw. and one 400-kw. set, approximating between $35,000 and $40,000. Marine business holds strong and shipyards in the New York and Philadelphia districts are securing sizable advance orders. The Kensington Shipbuilding & Drydock Company, Philadelphia, will complete a new pilot vessel for the Pilots' Association, the new contract calling for the installation of Diesel engines, electric lighting plant and refrigerating system. Construction projects are as follows:

The American Glanzstoff Corporation, New York, will build a second unit at its rayon mill near Elizabethton, Tenn., to cost $4,000,000. The Department of Street Cleaning, New York, has secured an appropriation of $5,000,000 for four refuse disposal plants in Manhattan and Bronx Boroughs. The Borden's Farm Products Company, New York, will build a milk pasturizing and distributing plant at White Plains, N. Y., to cost $150,000. The Harrison Radiator Corporation, Lockport, N. Y., will build an addition to cost $130,000. The Empire State Ice Company, New York, plans an addition to its ice-manufacturing and refrigerating plant to cost $240,000. The Manhattan Shirt Company, New York, will build an addition to its plant at Paterson, N. J., to cost $80,000. The Board of Education, Newark, N. J., will receive bids until Dec. 12 for electrical supplies, electric panels, electric time clocks, etc.

The W. Atlee Burpee Company, Philadelphia, plans a storage and distributing plant to cost $230,000. The Armstrong Cork Company, Pittsburgh, plans additions to its plant at Gloucester, N. J., to cost $100,000. The Fisher Scientific Company, Pittsburgh, plans an addition to cost $75,000. The Crown Cork & Seal Company, Baltimore, will build additions to its bottle-capping machinery plant to cost $1,000,000. The Bureau of Supplies and Accounts, Navy Department, Washington, will receive bids until Dec. 18 for two electric motors (Schedule 78), and at the same time for 367 storage batteries for a San Diego, Calif., yard (Schedule 96).

Business Quite Active in New England

Encouraging activity in sales, stimulated somewhat by the intentions of several companies to place a number of large electrical equipment orders before the end of the year, marks the business trend in the New England district. An equipment order recorded consisted of three 2,000-kva. transformers for a southern New England generating station and the same manufacturer also reported the sale of four 2,000-kva. transformers for a Southern plant.

Central-station supplies are in fair demand. The general trend in scheduled equipment, meters, regulators, switches and control, is steady, with some stocking up, and this month so far shows little slowing up in sales. Industrial equipment sales, especially motors, are active and orders totaling over $85,000 were recorded by one manufacturer which included large group orders from pumping apparatus manufacturers, tool machine manufacturers and others. Another manufacturer reports a good volume of sales of larger motors; a number of 50-hp. motors were sold, also a 100-hp. motor for power-factor correction. Industrial electric heating furnaces are in demand. A number of electric floodlighting projects are under consideration and an increased interest is reported for display effects. Appliance sales show a steady increase.

Central-Station Purchases Feature on Pacific Coast

Power company purchasing on the Pacific Coast has featured the past week. The outstanding orders included two carloads of 4-in. fiber conduit, $6,000 worth of varnished cambric cable, a carload of 32-in. crossarm braces and a carload of assorted bolts and washers, $3,000 worth of No. 10 single rubber and lead 4,500-volt cable and 500 untreated 8-in. 45-ft. poles. Manufacturers report a noticeable increase in stock orders for small distribution transformers, sizes 2½ to 100 kva., the sales for one manufacturer aggregating 300 for the week. The Southern Sierras Power Company is erecting six buildings at Riverside for housing its central stocks. The Turlock irrigation district is buying about $3,500 worth of weatherproof wire and lead signal cable. Railroad buying is again active, especially by the southern Pacific, which is planning 650 track-miles of telephone despatching circuits between Los Angeles, Yuma and San Luis Obispo and many multiplex printer installations and about $50,000 worth of recabling in its Oakland terminal oil company.

There have been no large sales of importance reported in the Puget Sound district, and in fact little new business is expected to develop until after the first of the year. The usual turnover of small motors, however, has been noted, these going to sawmills, paper mills and cement mills in Washington and Oregon. Paper mills particularly have been the source of most sales, as the sawmills generally have completed all their purchases for this year. The port of Vancouver, Wash., has asked for bids for furnishing and installing one 1,000-g.p.m. underwriter duplex steam fire pump, one 1,000-g.p.m. vertical steam turbine deep well pump and one 1,000-g.p.m. vertical motor-driven deep well pump. The city of Seattle is in the market for $14,200 worth of electrical equipment, including 20,000 lb. of No. 4/0 bare copper wire, 50,000 lb. of weatherproof copper wire and $1,600 worth of cedar poles. Construction projects are as follows:

The Anaheim Co-operative Orange Association, Anaheim, Calif., plans an addition to its packing plant to cost $90,000. The Crane Company, Chicago, plans a plumbing equipment manufacturing plant at Los Angeles, Calif., to cost $500,000. The Northwestern Electric Company, Portland, Ore., plans a hydro-electric power plant on the Cowlitz River, near Woodland, Wash., to cost $1,000,000. Los Angeles and Santa Maria, Calif., and Everett, Wash., plan ornamental lighting systems. The Isaacson Iron Works, Seattle, Wash., plans an addition to cost $100,000. The Spokane Electro-Kold Corporation, Spokane, Wash., contemplates a refrigerating equipment plant at Seattle, to cost $100,000. The Montana-Dakota Power Company, Minneapolis, Minn., plans a transmission line from Miles City to Glendive, Mont. The Hylton Flour Company, Ogden, Utah, plans a mill to cost $150,000. The Southern Colorado Power Company, Pueblo, Colo., will install an ornamental lighting system at Fowler, Colo.

Activities of the Trade

Wide Variation Found in Cost of Distribution

SOME facts interesting to manufacturers and distributors of electrical equipment should be found in a study recently undertaken by the National Carbon Company, Inc., the results of which were published in the October issue of the *Harvard Business Review* under the title "Analysis of Wholesalers' Operating Costs." The study is particularly timely in view of the wide interest being taken not only in other operating costs but in those costs arising particularly out of distribution. One fact of importance brought out is the reason why different products may entail widely varying handling costs and why the average cost of handling any whole line cannot safely be accepted in studying margins on any one line. The data compiled were secured from 43 jobbers in 27 states, and of these eleven were electrical.

The most difficult problem in connection with studying costs of distribution is to allocate the proper expense to particular products. Operating expenditures are ordinarily made for the benefit of many or all products jointly. Selling costs in the study were included, salesmen's salaries, commissions and expenses, catalogs, advertising and miscellaneous other selling expenses. The largest of these is salesmen's salaries, commissions and expenses. Another important expense is warehouse cost. This is subdivided into a number of individual items, such as wages of receiving and shipping force. Administrative expense constitutes another large element in jobbers' costs and this in turn is subdivided. The three bases of charging jobbers' operating costs to products that were used are:

1. Sales value of the various products.
2. Number of items of the various products.
3. Turn-over attained on the various products.

After the amount of expense charged to each product on each basis has been determined the total expense to each product may be arrived at simply by adding the three components together. By a series of comparative tabulations the study carries through the cost by units in groups and in proportion to total cost for various classes of products studied.

New Pacific Electric Factory

Early in the spring of 1929, according to Joseph Thompson, president of the Pacific Electrical Manufacturing Company, the new factory of the company, now in construction at Gary, Ind., immediately adjacent to the plant of the Walter Bates Steel Corporation, will be in operation. The plant now being erected will employ approximately 100 men. The western plant now has an employee roll of 240, but Mr. Thompson said he expected that within three years the Gary unit would be increased to a size requiring a larger number of men than the original factory. The company manufactures oil circuit breakers and a line of high-tension switches and related equipment which have been well received on the Pacific Coast and, from the location of the new factory, farther east as well.

Uniform Electrical Ordinance

Among the cities in which electrical code revisions are under way at the moment are Baltimore, Grand Rapids, Michigan and El Paso, Texas, according to Harry B. Kirkland, director of the uniform ordinance department of the Society for Electrical Development, Inc. He also announced that the following seven cities in North Carolina originally adopted the uniform electrical ordinance: Asheville, Raleigh, Greensboro, High Point, Charlotte, Winston-Salem and Salisbury.

Westinghouse Finance Plan

Announcement has just been made by the Westinghouse Electric & Manufacturing Company and the Commercial Investment Trust of a contract under which the latter will take over the installment financing of the former, formerly undertaken by the Westinghouse Acceptance Corporation. This latter company will accept no further business and its affairs are being wound up.

A new financing plan has been arrived at between the new organizations to take the place of that formerly existing. This new arrangement is expected to augment the volume of electric appliance financing handled by the Commercial Investment Trust, which in recent months has been named the official financing agency for the American Piano Company and the Radio Corporation of America.

Analysis of the company's financial position shows that during the current year there has been an increase in capitalization from $28,000,000 to $42,000,000. By the end of the current year the corporation will have total capitalization and surplus of more than $57,000,000. It has been estimated by the Commercial Investment Trust that the volume of business handled this year will amount to $270,000,000, as against $188,000,000 in 1927 and $206,000,000 in 1926.

Power and Mechanical Engineering Show Largest of Its Kind

MORE THAN 550 exhibitors from nearly all states and from many foreign countries entered exhibits at the seventh National Exposition of Power and Mechanical Engineering, held this week at the Grand Central Palace, New York. Products include generating and transmitting apparatus, heating, ventilating and refrigerating machinery, machine shop handling and safety equipment and electrical devices of every description from the smallest precision instruments to large equipment. However, some heavy equipment evident in former years was not on display.

While there is less new equipment on exhibit this year than is normally the case, a number of products are of special interest. These include an automatic frequency controller whose function is to control frequency within relatively close limits by direct connection to the governor-regulating motor on a steam or hydro turbine. The controller is of the proportional step type. Another new development is the addition of apparatus for automatically providing adjustable speed on stokers. A current transformer of a new type allows for current measurements ranging from 0.2 to 200 amp. when used in combination with a 1-amp. instrument. A new condenser type single-phase motor having a high power factor without commutator brushes or centrifugal devices is on display, and a new switchgear system for controlling substations is among the features. There was also starting equipment with ammeter plugs, push-button control and thermal overload protection and an automatic starter for synchronous motors giving full voltage at definite speed.

Further Lamp Price Cut

President Gerard Swope of the General Electric Company recently announced a further reduction in the prices of popular type automobile and flashlight lamps. This reduction averages 8 per cent on the types affected. This price reduction on miniature lamps is the tenth since 1920. Today's prices of "Mazda" miniature lamps are 52 per cent under the 1914 prices. The price changes are as shown in the accompanying table.

"Mazda," No.	Old Price	New Price
1	$0.10	$0.09
1,110	0.29	0.27
1,129	0.27	0.25
1,130	0.27	0.25
1,158	0.28	0.26
81	0.16	0.13
82	0.16	0.13

Johns-Manville Acquires Celite Products Company

The Johns-Manville Corporation, Inc., 292 Madison Avenue, New York City, has purchased the assets and the entire line of products of the Celite

Products Company. The Celite Products Company now brings to Johns-Manville an annual business of over $4,000,000 in net sales, of high temperature insulation and kindred lines, made from diatomaceous earth, a fossilized deposit derived from ancient sea life. Another valuable asset is the Celite holdings of this deposit in California, which is one of the largest known sources of this kind and quality.

THE FRIGIDAIRE CORPORATION, Dayton, Ohio, announces a new model four-hole Frigidaire portable ice cream cabinet. This model is designed for use at fairs, carnivals and other seasonal or temporary locations, as well as permanent places where this size is of sufficient capacity.

THE WESTERN ELECTRIC COMPANY has appointed W. H. Meese, assistant manager of its Hawthorne works, as manager of the new Baltimore plant, for the construction of which $15,000,000 was recently appropriated. G. A. Pennock has been appointed to succeed Mr. Meese at the Hawthorne works.

THE WAGNER ELECTRIC CORPORATION, St. Louis, announces the removal of its Los Angeles branch office and service station to 1220 South Hope Street. The removal involves all the local departments, the motor, transformer and fan, the service station and the Lockheed hydraulic automobile brake department.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order from the Pennsylvania Railroad for supervisory equipment to be used on the Phoenixville division of the Pennsylvania. The supervisory control equipment being supplied on this order is of the synchronous visual type and is being equipped for 31 points of control and supervision and four points of supervision only.

THE BOTFIELD REFRACTORIES COMPANY, Swanson and Clymer Streets, Philadelphia, manufacturer of "Adamant" fire brick cement, announces that the Marshall Supply Company, Inc., operating in Pittsburgh, Kansas and Tulsa, Okla., has been appointed as distributor of all its products.

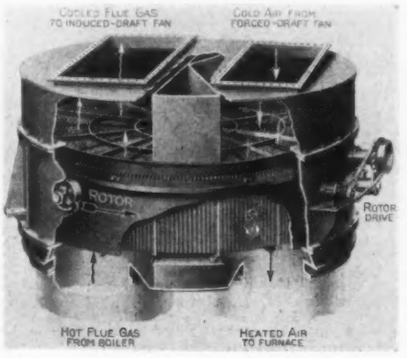
THE LINCOLN ELECTRIC COMPANY, Cleveland, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, has produced a motion picture portraying the application of electric arc welding in the fabrication and erection of the structural steel for the recently completed Upper Carnegie Building of Cleveland.

THE MCGILL MANUFACTURING COMPANY, Valparaiso, Ind., manufacturer of lamp guards, sockets, switches, etc., announces that V. R. Despard has resigned as vice-president and sales manager of its company. Mr. Despard has taken an interest in the Chicago Mica Company and the Fibre Insulation Company of Valparaiso, but he remains a director of the McGill Manufacturing Company. Charles S. McGill has succeeded Mr. Despard as sales manager.

New Equipment Available

Improved Ljungstrom Air Preheaters

A new method of increasing heat transfer efficiency and reducing apparatus volume, weight and cost, with correspondingly greater profits from heat recovery and air preheating, has been announced as a standard feature of Ljungstrom preheaters. The new



features are based on the substitution of undulating partition sheets for the former flat partition sheets. The undulations are in transverse direction to the vertical channels formed by the corrugations of the companion sheets.

The new arrangement, it is claimed, produces extremely quick heat transfer through the increased turbulence and wider penetration of flow, compelling the gas and air to strike against, instead of merely passing over, the metal surface. The heat transfer is accelerated to such a marked degree that a smaller volume of heating elements which are shorter and have passages twice as large in cross-sectional area will produce a given recovery. This reduces draft losses through both gas and air sides at all velocities and in connection with the turbulence affords a greater protection against fouling from soot. Other design changes have been introduced to make the arrangement more compact.

A BACKFILLER WINCH which operates in connection with the McCormick-Deering tractor has been announced by the Pontiac Tractor Company, Pontiac, Mich., manufacturer of the Pontiac air compressor and the Pontiac Lincoln arc welder. The product is designed to mount with either of the above units and when mounted with the compressor allows the operations of backfilling and tamping at the same time. These units make a clean, one-unit design, self-propelling machine with the drawbar free for hauling other equipment, and can be used for a variety of purposes.

THE EVEREADY SUNSHINE CARBON ARC LAMP has been designed by the National Carbon Company, Inc., Cleveland, to bring into the home benefits of natural sunlight. The lamp is rated at 115 volts, 1,300 watts. It will operate on either direct or alternating current at 105 to 120 volts. It is a twin-arc lamp, burning four carbons. The two arcs are in series, thereby reducing the amount of the ballast resistance and resulting in cooler operation. A chromium plated reflector, designed for most effective distribution of the light, is placed back of the arcs.

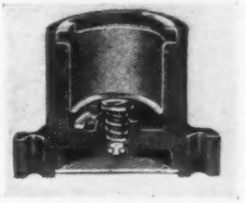
Combustion Meter to Detect CO_2

A combustion meter has been developed by the Hays Corporation, Michigan City, Ind., to record CO_2 in combustion with either furnace draft or flue gas temperature, or as a combined recorder for CO_2 draft and flue gas temperature.

The new model C retains the same Orsat principle of operation as that used in its predecessors, changes having been made in the recording rather than the analyzing parts. The standard pens containing the circular charts and the new silhouette type aluminum chart case with polished aluminum door are features of the new model. Another feature is the draft attachment, the pen of which is actuated by a special slack leather diaphragm.

Bryant Prefocusing Sockets

For the control of light, especially on air routes and landing fields, in connection with the use of the photo-electric cell in photophone equipment, for general photographic work and for other uses where correct reflecting of light is important the Bryant Electric Company, Bridgeport, Conn., has developed a prefocusing socket. The relative



positions of the lamp filament and the reflector are always the same.

The sockets are made with a heavy spring center contact and slots at the upper inside edge of the shell. Lamps to fit these sockets are made with two lugs on opposite sides of the base which fit into these slots in the socket. When the lamp is inserted in the socket the spring center contact forces it into position so that the filament of the lamp is invariably turned to the angle desired and is at the same distance from the base of the socket. Used with these sockets are 110-watt, 115-volt, T8½-bulb and 200-watt, 115-volt, T10-bulb coiled-filament projection lamps.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 20, 1928)

17,138 (reissue). CONVERTIBLE ELECTRIC-APLLIANCE-RECEIVING BOX; J. Sachs, Hartford, Conn. App. filed July 26, 1916.

17,141 (reissue). APPARATUS FOR PRODUCING ARTICLES BY ELECTROLYTIC DEPOSITION; G. Rosenqvist, Pittsburgh, Pa. App. filed Feb. 24, 1925.

1,691,915. SWITCH-OPERATING MECHANISM; C. H. Bourgeois, Toledo, Ohio. App. filed March 25, 1926.

1,691,916. RHEOSTAT; A. C. Brady, Brooklyn, N. Y. App. filed Feb. 26, 1927.

1,691,917. DUPLICATING MACHINE; O. E. Braitmayer, New York, N. Y. App. filed July 23, 1923.

1,691,920. ELECTROMAGNETICALLY-ACTUATED SWITCH; G. H. Chapman, Chicago, Ill. App. filed May 5, 1921.

1,691,921. STRANDED SECTOR-SHAPED CONDUCTOR; N. C. Davis, Perth Amboy, N. J. App. filed April 20, 1927.

1,691,943. ELECTRICAL WATER HEATER; E. C. Steere, Sydney, New South Wales, Australia. App. filed March 10, 1926.

1,691,984. ELECTRIC SWITCH; J. M. Miller, Detroit, Mich. App. filed Aug. 19, 1925.

1,691,986. APPARATUS AND METHOD FOR GENERATING PURE SINE WAVES OF ELECTROMOTIVE FORCE; H. Nyquist, Elmhurst, N. Y. App. filed March 30, 1922.

1,692,050. DEEP-WELL PUMP; W. C. Parrish, Port Arthur, Tex. App. filed April 16, 1924.

1,692,056. ELECTROMAGNET; W. S. Smith, Cambridge, Mass. App. filed July 28, 1922.

1,692,063. PIEZO-ELECTRIC-CRYSTAL APPARATUS; A. M. Trogner, Takoma Park, Md. App. filed April 24, 1926.

1,692,065. ELECTRIC RANGE; A. W. Walker, Malden, and A. L. Smith, West Medway, Mass. App. filed May 7, 1924.

1,692,068. MULTIPOLE MULTIBRANCH ELECTRIC SWITCH; A. R. Wolfe, Summit, N. J. App. filed April 3, 1925.

1,692,069. LAMP; B. Ames, Lowell, Mass. App. filed June 19, 1926.

1,692,074. OSCILLATION GENERATOR; W. H. Burtis, Plainfield, N. J. App. filed April 21, 1927.

1,692,097. FLOOR OUTLET; E. A. Staples, Brooklyn, N. Y. App. filed Dec. 6, 1920.

1,692,104. CABLE SUPPORT; H. B. P. Wrenn, Cleveland, Ohio. App. filed Nov. 28, 1924.

1,692,114. ELECTRIC MOTOR WINDING MACHINE; J. K. Darby, Dayton, Ohio. App. filed Dec. 15, 1926.

1,692,119. METHOD FOR MEASURING DISTANCE; H. C. Hayes, Washington, D. C. App. filed Jan. 31, 1922.

1,692,124. SWITCH ARRANGEMENT FOR ELECTRIC-LIGHT INSTALLATIONS AND THE LIKE; R. Hürlimann, St. Gallen, Switzerland. App. filed Aug. 20, 1926.

1,692,133. SEWER BOAT; S. W. McClave, Jr., R. P. McClave and B. D. McClave, Cliffside, N. J. App. filed Feb. 9, 1925.

1,692,138. MULTIPHASE EQUIPMENT PROTECTION; A. N. Orr and S. H. Goldberg, Chicago, Ill. App. filed March 17, 1922.

1,692,164. HEATER; H. E. Fromm, Detroit, Mich. App. filed Dec. 20, 1928.

1,692,217. STORAGE BATTERY; T. E. McCarty and H. E. Salisbury, Oakland, Calif. App. filed Aug. 7, 1926.

1,692,221. ELECTRIC BURNER; C. M. Osterheld, Stoughton, Wis. App. filed Nov. 22, 1924.

1,692,240. CADMIUM-PLATING BATH; A. W. Young and M. E. Louth, Kokomo, Ind. App. filed March 31, 1926.

1,692,245. ELECTRIC MACHINE FOR WELDING METALLIC TUBES OR PIPES; F. Brero, Turin, Italy. App. filed Oct. 25, 1926.

1,692,251. ELECTRICAL WALL-BRACKET SUPPORT; H. D'Olier, Jr., Bridgeport, Conn. App. filed Feb. 16, 1927.

1,692,270. APPARATUS FOR TREATING LIQUIDS; A. Jensen, Los Angeles, Calif. App. filed Jan. 10, 1927.

1,692,272. SUPPLEMENTAL RESISTANCE FOR SERIALLY-MOUNTED LAMPS; A. Lampl, Berlin-Halensee, Germany. App. filed Nov. 9, 1925.

1,692,292. ELECTRIC FLASHER DEVICE; W. Dubilier, New Rochelle, N. Y. App. filed Oct. 25, 1926.

1,692,316. STORAGE BATTERY; E. W. Smith, Philadelphia, Pa. App. filed Dec. 31, 1927.

1,692,321. INSTANTANEOUS ELECTRIC WATER HEATER; G. J. Zisch, Newark, N. J. App. filed Jan. 27, 1927.

1,692,327. ELECTRIC UPSETTING OR JOLTING MACHINE; F. Brero, Turin, Italy. App. filed Oct. 25, 1926.

1,692,331. VARIABLE INDUCTANCE; N. H. Clough, Chelmsford, England. App. filed Jan. 3, 1925.

1,692,408. ELECTRIC MOTOR; J. W. Hobbs, Moline, Ill. App. filed Dec. 9, 1926.

1,692,409. OSCILLATING MOTOR; J. W. Hobbs, Moline, Ill. App. filed May 21, 1927.

1,692,414. ELECTRIC-WIRE CONNECTER; W. P. Marr, Toronto, Ont., Can. App. filed Oct. 13, 1926.

1,692,445. ELECTRIC FUSE; V. Hope, Macclesfield, England. App. filed Oct. 16, 1924.

1,692,474. ELECTROTHERMAL DEVICE; O. C. Traver, Schenectady, N. Y. App. filed March 11, 1925.

1,692,478 and 1,692,479. ELECTRIC FURNACE; J. Weintz, Cleveland, Ohio. Apps. filed Jan. 26 and Oct. 3, 1927.

1,692,486. THERMAL AND ELECTRORESPONSIVE DEVICE; A. Cohn, Charlottenburg, Germany. App. filed May 2, 1927.

1,692,488. ELECTRICAL HEATING AND FORMING METHOD; A. G. Dannell, New York, N. Y. App. filed May 11, 1927.

1,692,495. QUICK-EXCITED MACHINE AND SYSTEM OF TRANSMISSION; R. D. Evans, Pittsburgh, and C. F. Wagner, Swissvale, A. D. Dovjikov, Wilkinsburg, and E. B. Shand, Pittsburgh, Pa. App. filed Sept. 9, 1927.

1,692,530. METHOD AND APPARATUS FOR LOCATING ORE BODIES; T. Zuschlag, New York, N. Y. App. filed May 15, 1925.

1,692,540. THERMOSTATICALLY-OPERATED SWITCH; E. L. Benson, Pueblo, Colo. App. filed Sept. 3, 1921.

1,692,547. PORTABLE ELECTRIC COOKER; M. Evans, Washington, D. C. App. filed Dec. 19, 1922.

1,692,571. FLOOR PLATE AND HANGER; W. R. Rein, Chicago, Ill. App. filed April 16, 1926.

1,692,604. SWITCH MECHANISM; G. H. Whittingham, Baltimore, Md. App. filed April 26, 1924.

1,692,626. ELECTRICALLY-HEATED IMPLEMENT HANDLE; C. M. Chapman, Terryville, Conn. App. filed March 31, 1926.

1,692,629. ELECTRIC FLASH-LIGHT APPARATUS; G. Dalén, Stockholm, Sweden. App. filed July 10, 1923.

1,692,646. SYSTEM FOR HEATING WATER; J. E. Gannon and M. W. Ward, Erie, Pa. App. filed Dec. 29, 1926.

1,692,656. ELECTRICITY METER; J. Harris, La Fayette, Ind. App. filed Dec. 27, 1926.

1,692,678. ELECTRICAL CONNECTION; T. H. McComsey, Los Angeles, Calif. App. filed Nov. 26, 1924.

1,692,710. CONDUIT BUSHING; J. A. Spahn, Wilmington, Del. App. filed Feb. 25, 1925.

1,692,718. MAGNETO; P. Brown, Springfield, and I. E. Hendrickson, West Springfield, Mass. App. filed Dec. 3, 1926.

1,692,729. CLOCK AND TIME CONTROLLED SWITCH FOR ELECTRIC LIGHTS; F. Grossi, Providence, R. I. App. filed Jan. 27, 1927.

1,692,732. ELECTRIC-LIGHT SOCKET AND BULB BASE; P. S. Hall, Austin, Minn. App. filed Sept. 22, 1926.

1,692,735. ELECTROMOTOR; B. Heger, Vestre Aker, near Oslo, Norway. App. filed Feb. 16, 1925.

1,692,757. ELECTROLYTIC APPARATUS; F. C. Nixon, Apollo, Pa. App. filed Feb. 18, 1927.

1,692,761. MAGNETIC MOTOR; S. Osser, Wichita, Kan. App. filed June 21, 1926.

1,692,767. STANDARD SECTOR-SHAPED CONDUCTOR; N. C. Davis, Perth Amboy, N. J. App. filed March 31, 1928.

1,692,781. ELECTRIC HEATING DEVICE; J. F. Lamb and J. F. Smart, New Britain, Conn. App. filed Oct. 20, 1925.

1,692,798. CONDUIT COUPLING; F. M. Potter, Rome, N. Y. App. filed Aug. 19, 1925.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Hamburg, Germany (No. 34,650), for flash-light batteries.

An agency is desired in Milan, Italy (No. 34,684), for electric clocks and time switches, elapsed time recorders and fire-alarm systems, and another (No. 34,685), for electric railway car equipment.

A sole agency is desired in Sydney, Australia (No. 34,746), for electrical dental equipment.

An agency is desired in Quebec, Canada (No. 34,683), for electrical hand dryers.

An agency is desired in Rotterdam, Netherlands (No. 34,735), for fixtures.

An agency is desired in Vienna, Austria (No. 34,682), for household electric appliances.

Purchase is desired in Zurich, Switzerland (No. 34,670), of electrical lemon squeezers.

Purchase and agency are desired in Lausanne, Switzerland (No. 34,677), for the best quality of lighting fixtures.

Purchase is desired in Ciudad Juarez, Mexico (No. 34,731), of lighting fixtures for school.

An agency is desired in Montreal, Canada (No. 34,674), for beacon and flood lights.

Purchase is desired in Alicante, Spain (No. 34,672), of electric meters.

An agency is desired in Oporto, Portugal (No. 34,681), for electric motors.

An agency is desired in Madellin, Colombia (No. 34,686), for electric motors and portable electric tools.

Purchase and agency are desired in Bilbao, Spain (No. 34,671), for phonograph pick-ups.

An agency is desired in Para, Brazil (No. 34,710), for small, centrifugal electric pumps.

Purchase or agency is desired in Cardiff, Wales (No. 34,679), for household electric refrigerators.

Purchase is desired in Luxemburg, Luxemburg (No. 34,680), of tungsten filaments.

Purchase is desired in Amsterdam, Netherlands (No. 34,675), of electric washing machines with spinner and household electric water heaters.

An agency is desired in Valparaiso, Chile (No. 34,646), for wiring equipment and incandescent bulbs.

New Trade Literature

WATER-POWER CONTROL. — The Woodward Governor Company, Rockford, Ill., is distributing a publication entitled "Water Power Control." This publication is offered monthly and is intended to present a means for maintaining contact with the latest ideas in hydro plant operation and governor development. In the October issue are articles on the Saluda development of the Lexington Water Power Company, on pilot exciter drive, on dual control, on speed matchers, etc., and a discussion of hydraulic unit outages compiled by the N.E.L.A.

ELECTRICITY. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued circular No. 1820, entitled "Electrification in the Petroleum Industry." The booklet contains numerous illustrations, combining brief bits of history, useful information and a general discussion of the petroleum industry's methods. Power supply, drilling, pumping, lighting, transportation, refining and marketing are discussed and various sections are devoted to the discussions of auxiliary equipment, arc welding, turbine applications and condenser equipment for refining, gearing requirements and filling station equipment.

WATER SOFTENERS.—The International Filter Company, 333 West 25th Place, Chicago, is distributing bulletin No. 183 covering the International Crystalite water softeners. The bulletin discusses the chemistry of zeolite water softening, the early history and development of zeolites, Crystalite the super-rapid zeolite, the advantages of upflow softening illustrated with curves, and the adaptability of Crystalite to upflow softening. Illustrations showing the installations of the water softener are given and the important uses of Crystalite softened water are listed.

ELECTRIC EQUIPMENT. — Bulletin GEA-922 issued by the General Electric Company, Schenectady, N. Y., covers electric equipment for the petroleum industry. The bulletin describes and illustrates apparatus manufactured for the petroleum industry by the General Electric Company and indicates the scope of its use and its superiority to other methods of obtaining and applying power.

MATERIAL-HANDLING EQUIPMENT. —"Jacklift and Stacker Practice" is the title of an annual publication issued by the Lewis-Shepard Company, Watertown Station, Boston, in which it describes and illustrates the uses of the Lewis-Shepard jacklifts and stackers in the various industries.